THE JOURNAL OF GAS LIGHTING
WATER SUPPLY & SANITARY IMPROVEMENT

VOL. LXXXII. No. 2091.] LONDON, JUNE 9, 1903. [55TH YEAR. PRICE 6d.

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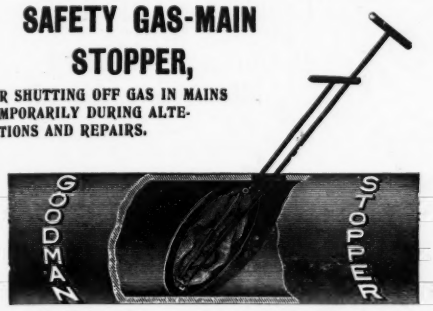

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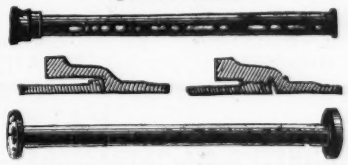

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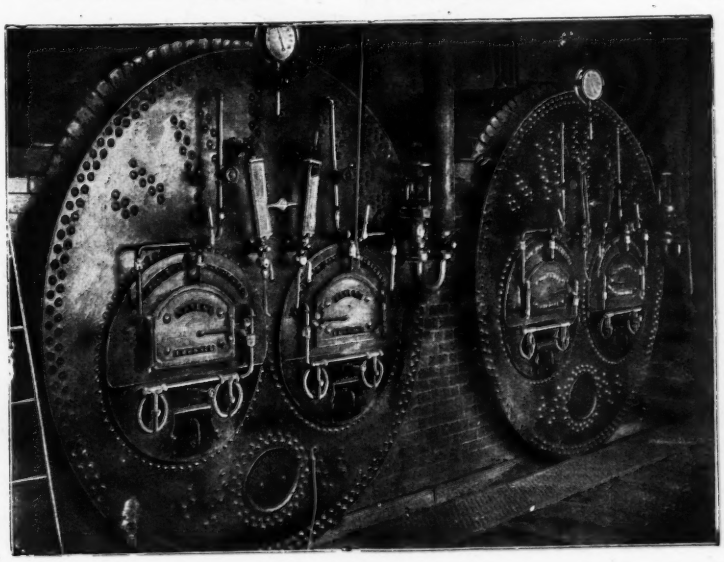

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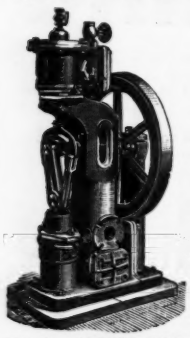

Fig. 705. "SINGLE RAM" STEAM-PUMP.

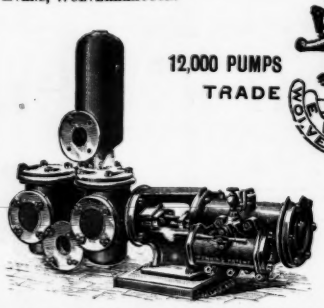

Fig. 598. "CORNISH" STEAM-PUMP FOR BOILER FEEDING, &c.

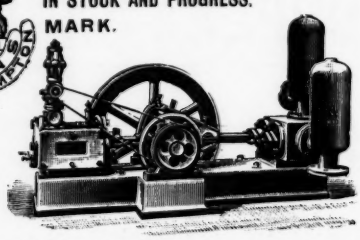

Fig. 685. "RELIABLE" STEAM-PUMP FOR TAR AND THICK FLUIDS.

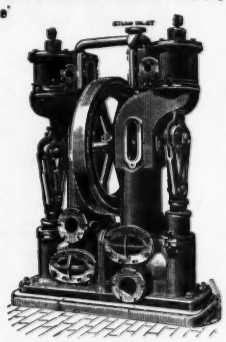

Fig. 712. "DOUBLE-RAM" STEAM-PUMP.

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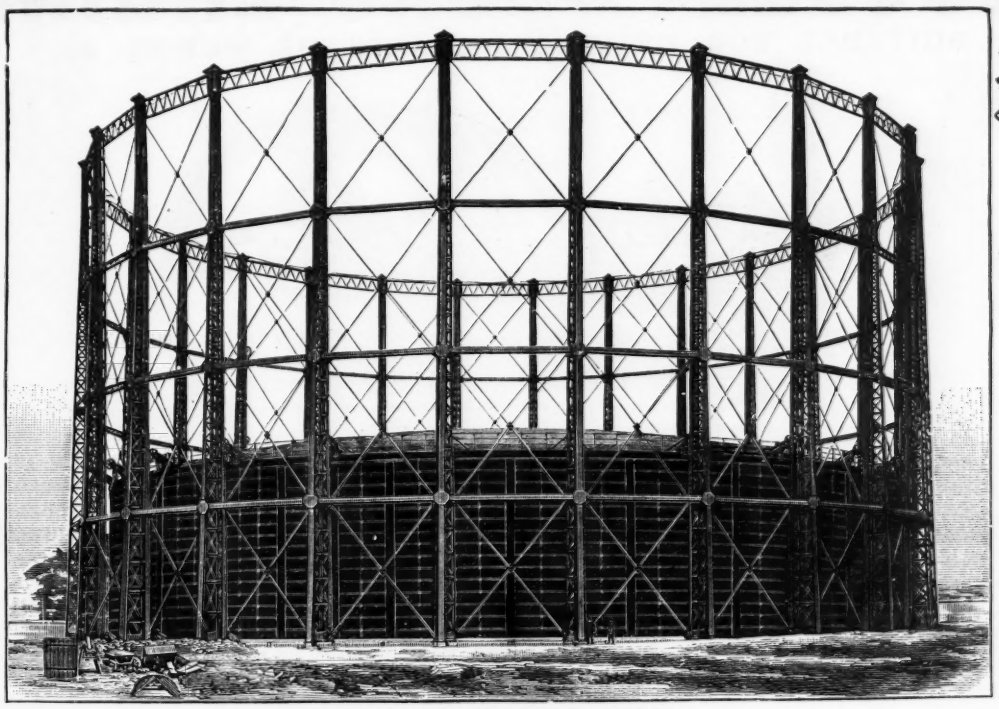

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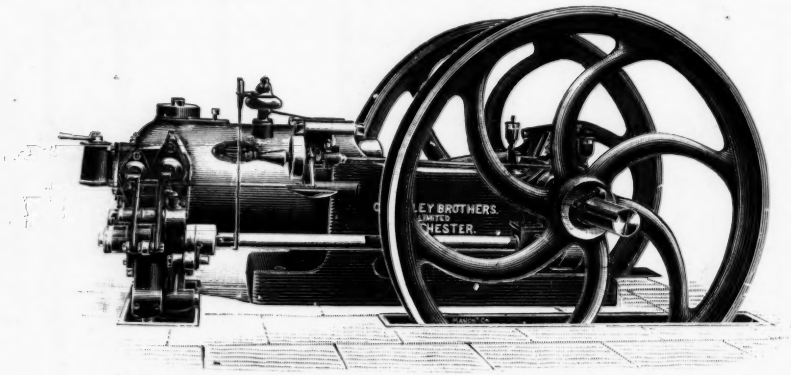

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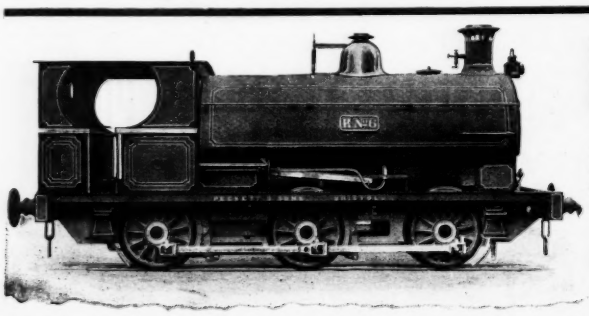

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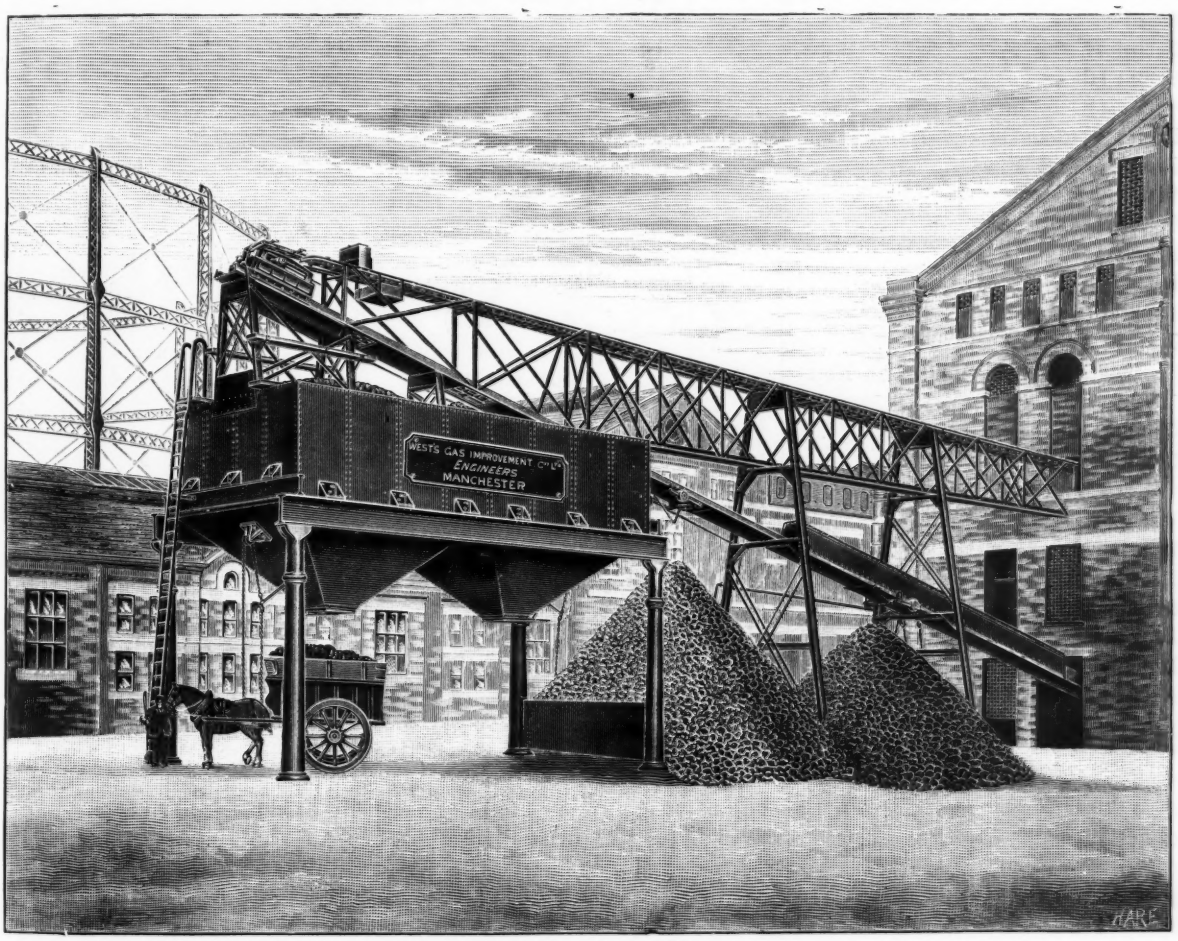

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Barcelona	14	126	Lübeck	4	35
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Berlin II.	14	126	Malaga	6	54
Berlin III.	15	135	Malmoe	12	108
Berlin IV.	24	216	Mariendorf, Berlin, I. C. G. A.	32	288
Berlin V. (Schmargendorf)	20	180	Mannheim	6	54
Berlin, I. C. G. A.	46	414	Mainz (Maintz)	7	63
Bielefeld	8	72	Muelhausen i. Els.	10	90
Bockenheim, near Frankfort	29	261	Muehlhausen i. Th.	4	36
Bremen	30	270	Mailand (Milan)	24	216
Brooklyn (U.S.A.)	5	45	München-Gladbach (Munich)	8	72
Brüssel (Brussels)	8	72	Pest (Pesth)	15	145
Cassel	17	153	Pest Mineralölfabrik	1	3
Central Union Gaslight Co., New York	6	54	Posen	6	54
Charlottenburg	32	288	Plauen i. Voigtl	6	54
Chemnitz	27	243	Odense	9	72
Coblenz	13	117	Randers	4	36
Darmstadt	12	108	Remscheid	3	27
Danzig	20	180	Rostock	6	54
Dresden II.	14	126	Rixdorf	12	108
Dresden III.	10	90	Stettin	21	189
Drontheim	2	18	Stockholm	24	216
Düsseldorf	8	72	Strandvej	4	36
Esslingen	3	27	Trieste	18	162
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Frederiksberg	27	233	Witten	4	36
Flensburg	6	54	Wittkowitz	4	31
Gera	9	81	Wien (Vienna)	186	1674
Genf	7	63	Zürich	32	288
Göttingen	10	90	Berlin-Tegel	40	360
E. & J. Gutmann, Wien	2	6	Nürnberg	32	288
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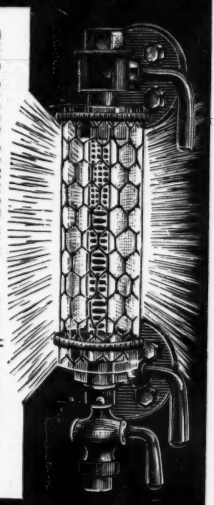

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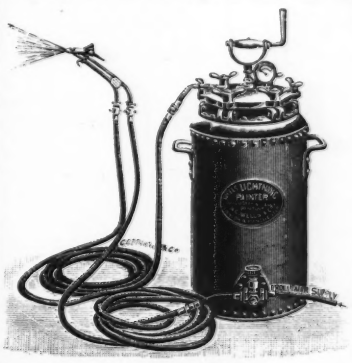

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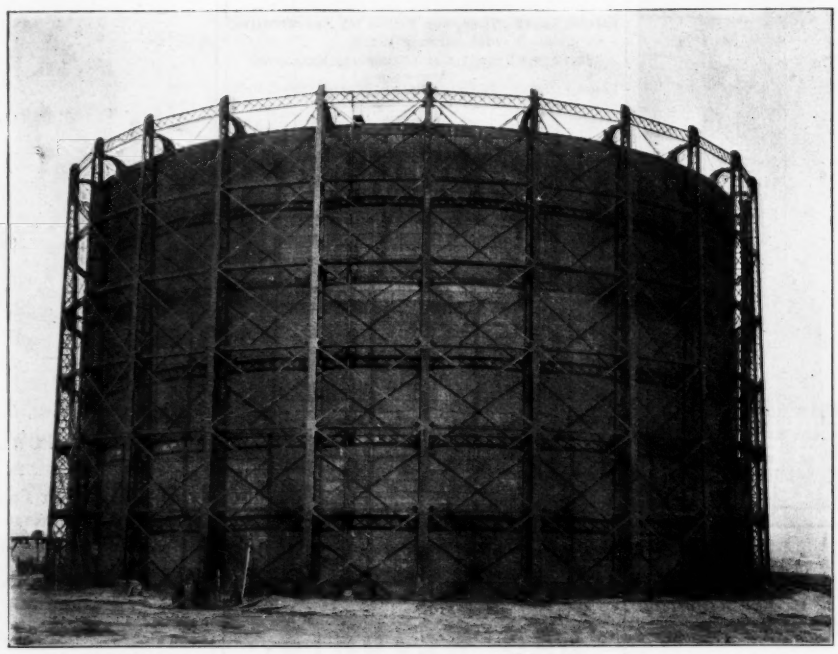

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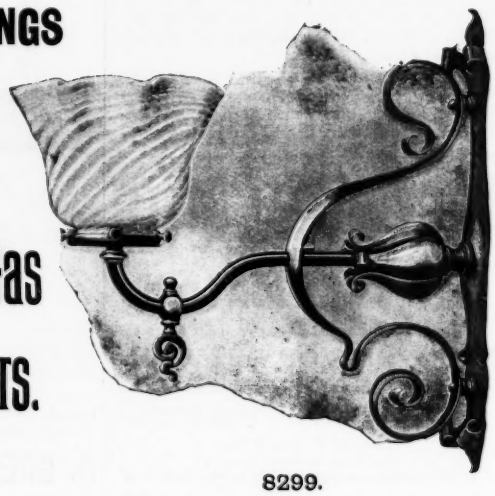

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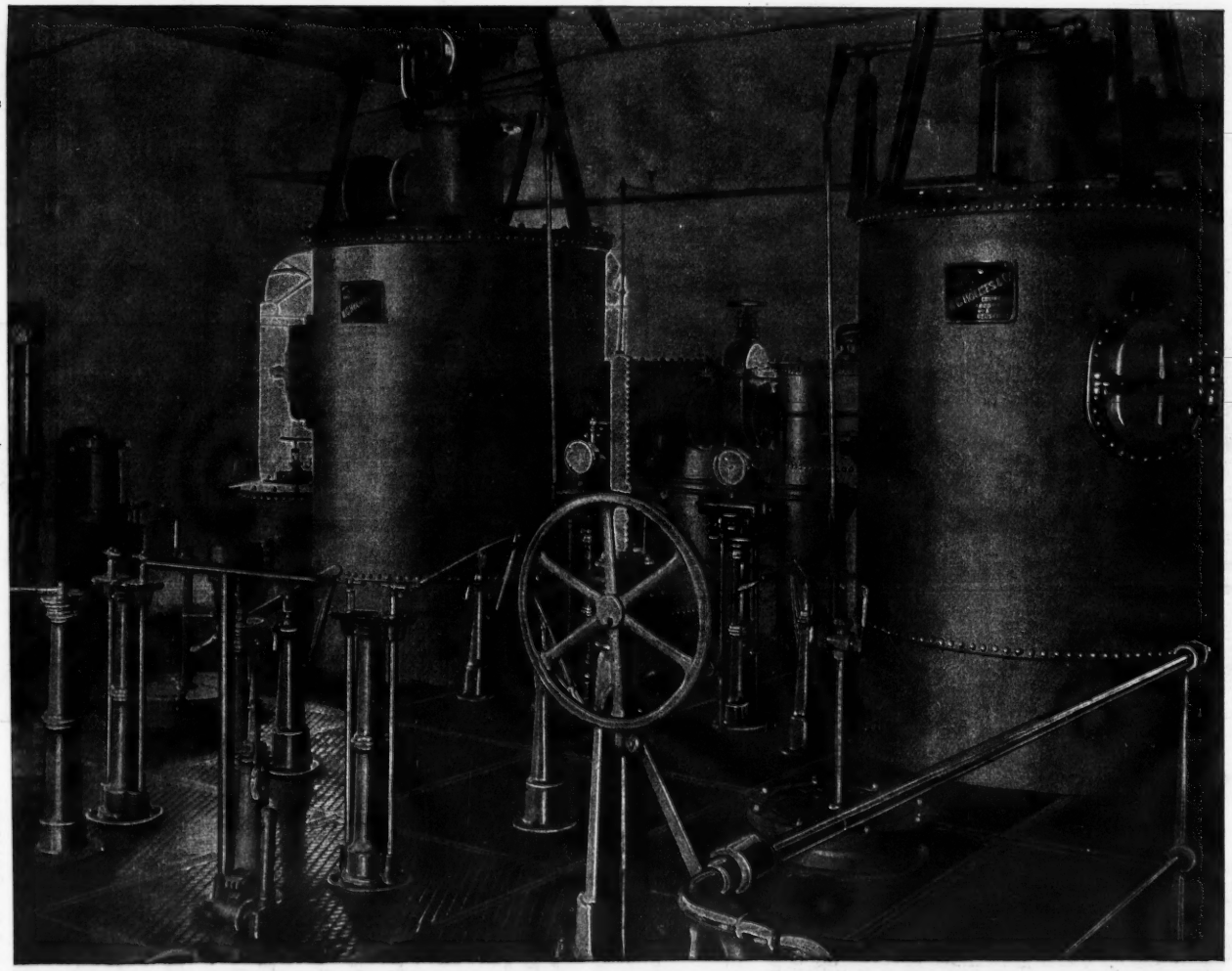

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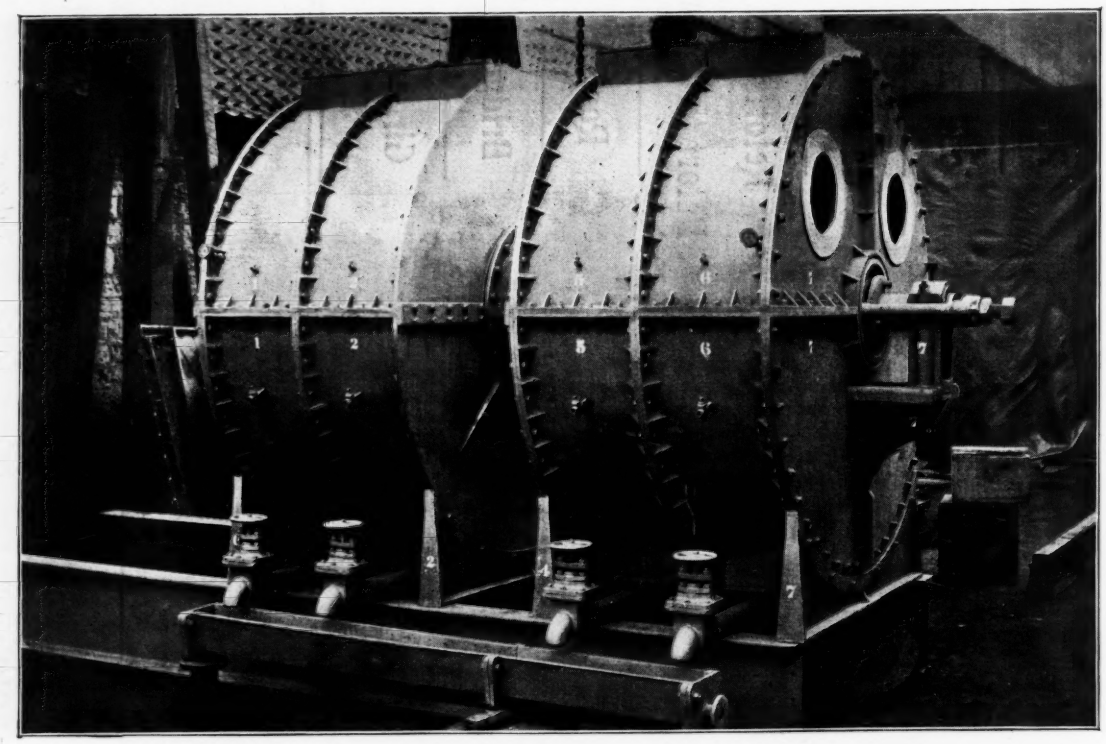

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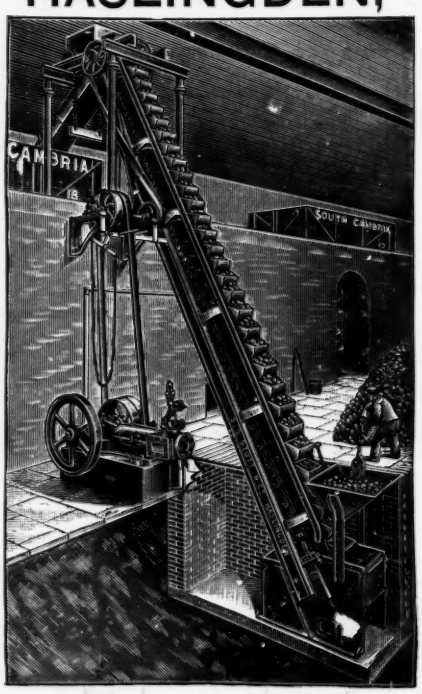

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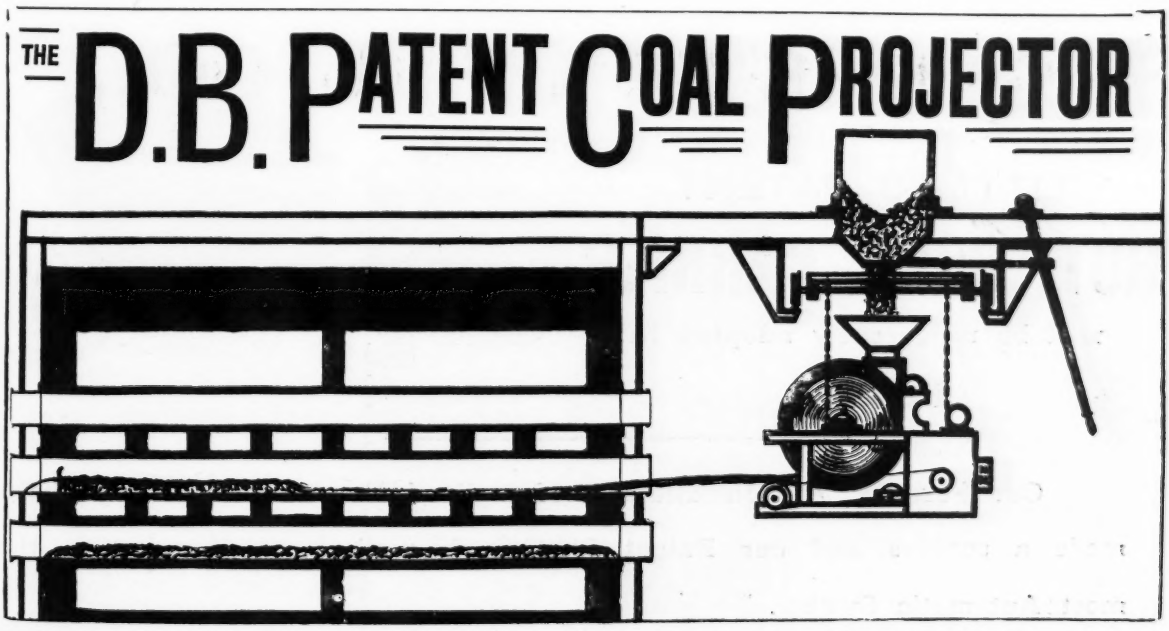

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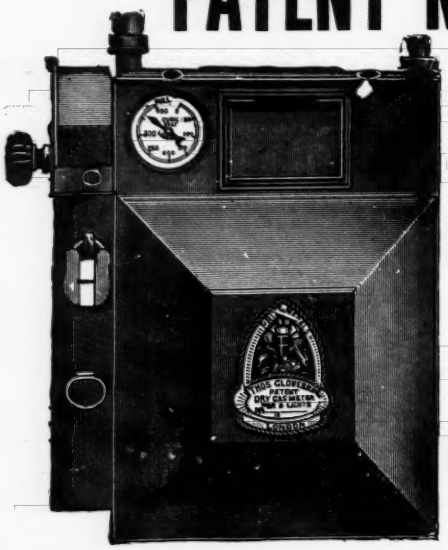

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VOL. LXXXII., No. 2091.—TUESDAY, JUNE 9, 1903.

EDITORIAL NOTES.

Gas-Works as Assets.

In all the discussions that so frequently arise concerning the finance of gas supply, electric lighting, or other public service undertakings which are carried on indifferently by the employment of capital privately subscribed or borrowed on the security of the rates, the touchstone of solvency is apt to escape specific mention. This is especially true of most references to gas undertakings, in regard to which there is presented the remarkable inconsistency that, while a certain order of opinion professes to class the whole gas industry as dying, there is another which takes its solvency for granted. There are publicists galore who, if anyone talks to them about the probable condition of the gas industry fifty years hence, will reply that it is a baseless assumption that the industry has any such expectation of life. On the other hand, wherever the supply of gas is a municipal business, no dread of what the future may have in store deters the administration from treating the undertaking as a permanent asset. No question ever arises as to the solvency of the gas undertaking as a going concern; no criticism is ever directed to clearing up the prospect of its continuing to be so within any period to which the care of the present generation should properly extend. To put the point as concisely as possible, no local authority owning gas-works ever seems to contemplate the eventuality of the undertaking becoming chargeable upon the rates.

Of course, as regards gas companies, theirs is a trading risk which the proprietors have to face; and whether they do so in confidence that their dividends are not likely to fail, or whether they entertain any secret doubts on this head, is their affair. There is nothing new in this observation. It has always been maintained in these columns that supplying gas is a commercial business. The enhancement of gas stocks to prices equal to those of the best securities has never won the approbation of the most prudent and far-sighted of gas company administrators, who have always proclaimed their preference for a more strictly industrial valuation of gas shares. As regards the municipal investment in gas property, the Prime Minister recently mentioned his own doubts as to whether the enormous amount of this commitment is altogether justified; and there is reason for this attitude of reserve towards a fact of the times which, as already remarked, is too commonly taken for granted. Not that there is anything substantial about the statements volunteered in regard to the cessation of gas manufacture within fifty years, or at any yet more remote period. It is rather that any particular gas undertaking is a commercial venture, like another business, depending for the ability to keep up its profits upon a number and variety of conditions which are subject to change, as much in the case of a municipal undertaking as of a company.

It is a subject for speculation, in every example that might be selected, as to how the value of the investment is tending, or in what sense the cost of carrying on the business varies with its volume. The former question involves the much-debated, never-settled problems of depreciation and an open capital account. In the case of a gas company, the value of the capital stock is known. It constitutes the best, and indeed the only, test of the financial standing of the investment. It may in some case be a little too high or too low; but there are too many individual interests on the watch for it to go very wide of the truth. In the case of a municipalized undertaking, this test is lacking. It is therefore all the more incumbent on those who are responsible for the finances of such a business to make quite sure that the assets representing the capital commitment increase in relation to the latter quantity. Is this invariably the case? It should be so, in order to justify the general confidence displayed by municipalities towards their gas property. Generalities are beside the mark here. Wise and prudent administrators of any class of property, particularly if it is a trust, do not govern their actions on general principles, but satisfy themselves that their own special investment is justified in the circumstances. Gas capital can be wasted on unproductive works and unprofitable extensions; and it can also be kept to burden a business when it ought to have been written off long before. These are mere commonplaces, of course; but, unfortunately, ill-advised financial administration is also a commonplace of all time and in every place. It would be deplorable if gas directors and committeemen, after all that is said about the weakness of electric light finance, were to give the enemies of their own industry occasion to scoff.

It is, broadly speaking, for the management of a gas undertaking to look after the revenue account, while the superior control takes care of the capital. A smart manager naturally wants to have everything in the material part of his charge thoroughly up to date; and the more trade he can bring into his accounts, the better he is pleased. It is far from his interest to have an overloaded capital account; and if his judgment is sound, he will rather pay for everything he can legitimately charge to revenue, as the opportunity serves. Yet it is also the manager's business to show as large a profit as possible, for his credit's sake; and after this is accomplished, his responsibility yields to that of the administration. It is directors who recommend the rate of dividend, and the corporation gas committee who dispose of the profits of municipal trade. The point here is that, of the two, the stronger and more perspicacious treatment of the capital account is required of the latter body, whereas the influences amid which such bodies originate, and by which they are affected in all they do, are against it. Men are often superior to their surroundings; and English public life is frequently illogical. But for the defects of a democratic system there is no sovereign cure; and weak finance is one of the shortcomings of popular Governments.

The Great Fiscal Question.

Since we wrote last week on the introduction of the great fiscal question by Mr. Chamberlain and the Prime Minister, nothing has transpired to advance the matter in any way. Yet it is distinctly amusing to notice that those Trade Union pontiffs, and other professional fuglemen of working-class opinion, who are always ready to "demonstrate" or to "resolve" about everything which looks like a question of politics, have taken advantage of certain Whit-week gatherings to publish in advance their weighty denunciations of whatever the Government may propose. This sort of thing brings to mind the story of Lord Melbourne, who, when Premier, used to welcome the *agenda* of every Cabinet meeting by comprehensively consigning to eternal perdition everybody and everything brought under his notice. This done, he would proceed to business. So, in all probability, the public will have to endure patiently, while the howls of perfunctory deprecation ring through the land from Progressive camps, wherein it is the rule to make believe that nothing has altered in regard to fiscal matters for sixty years. Of course, this may be so; but, at least, it will not hurt anybody to inquire. The English currency is not insulted by the yearly trial of the pyx.

Inasmuch as readers of the "Journal" who do us the honour of taking our editorial observations seriously, may experience, in company with other sober citizens, a desire to look up the authorities before allowing themselves to form any definite opinion on the topic of the day, we have taken some pains to ascertain who or where is the fountain-head of economic wisdom. From the very confident way in which many people talk of such matters, one would think that such wisdom, cut and dried, is to be had for the asking. Perhaps it is; but, anyhow, the address at which application should be made has not been published. Of works on Economic Science there is no end, indeed; and there are many living professors of this particular order of knowledge. Unfortunately, the repositories of economic lore are as museums, and much of it is very dusty. One voice tells a different tale from another; and in the case of none is there any harmony of principles with practice. It is impossible to deduce from the writings of such a master as Dr. Pierson, any indication of what his policy would be as

Prime Minister. They are all Economists; but some are Free Traders and some ardently Protectionist. Nay, a whole community may profess one doctrine and practise its opposite. The Manchester School needs no definition; yet Manchester Free Traders have always taxed local gas indirectly about 15 per cent. *ad valorem*. Of course, we are all Free Traders, as we are all Friends of Peace. Only—well, we like to keep something in hand in case other people do not play the game properly!

Profit-Sharing in Excelsis.

A NEW method of working the principle of profit-sharing is reported from the United States, which is worthy of notice for its boldness, if for no other reason. A certain Company having an establishment at Evansville, Wisconsin, went through a process of reconstitution, as a result of which the capital was put at $300,000. Of this amount, $200,000 was declared to be preferred and fully-paid stock; the balance being set apart for sharing profits equally between capital, and sums representing the capital value of the labour share in the undertaking. Every profit-sharer was credited with as much of this capital as would, at 5 per cent., produce the amount of his wages. The rate of preferred stock interest is the same. Therefore, supposing the divisible profit for the year to be 10 per cent., the holder of every $10,000 of preferred stock would receive, at 5 per cent., first $500 as preference dividend, and afterwards a further 5 per cent., making the full 10 per cent. coming to him. Equally, the workman whose wages amounted to $500 for the year, and whose capitalized stake in the concern was therefore $10,000, would first of all receive his wages, and in addition his dividend of $500 on his allotted share of the capital. As a matter of fact, last year the profit of the business was such that every man who earned $600 in wages received also $496·20 by way of dividend. This is a very remarkable system—putting the workpeople of the firm upon an entirely new basis, and offering them an enormously larger share as profit than any scheme previously heard of. Indeed, one would almost think there must be something wrong about the figures; because at a capitalization of $10,000 apiece, the whole of the profit-sharing capital would be used for ten men. This cannot be meant; because the account of the experiment from which we take the figures mentions that "the result in the community has been better educa-" tion among the majority of the people, a great increase in " the number of cottage homes, and the introduction of a " much higher standard of living throughout the town." If all this were effected by ten men, albeit heads of families, the leaven must be intensely strong, or the community very small. The mystery requires clearing away; because the story as it stands is as impossible of comprehension as the facts, if they were intelligible, would be interesting. The authority given for the statement in a contemporary is the " Independent," of the United States, dated March 12 last. If, under a *régime* of Protection, a workman can earn as his fair share of the profits of his employers a sum equal to five-sixths of his wages, a good many of us would reconsider any objections we might have entertained to a Tariff.

The Bermondsey Clause.

THE Bermondsey clause is greatly disliked by electricians interested in the extension of electric lighting by small local authorities; and we are greatly indebted to the " Electrician " for candidly admitting that if gas companies succeed everywhere in getting the clause inserted in the Electric Lighting Orders of local authorities, " the spread " of electric lighting to small towns will be considerably " retarded." Surely, it were better so than that electric lighting should be spread on false pretences. What those who object to the clause have never yet faced, is the fact that it accepts the pretension upon which, nine times in ten, an Electric Lighting Order is applied for. If the ratepayers were not persuaded that the thing will pay, they would never sanction it. Why, then, should those who have told the ratepayers this story object to be taken at their word? It is all very well for the " Electrician " to argue that " it is " well known " that an electricity supply works " may often " of necessity be run at a loss during the first years of its " life." Provisional Orders are not promoted that way.

It is made out to be something monstrous that gas companies, in their capacity of ratepayers, should take the initiative in asking for the Bermondsey clause; but one would like to know why they should not. If they were to stand aloof, the railway companies and other large ratepayers would not be slow to take the same step for their own protection. It is all nonsense to say that gas companies, by insisting on the Bermondsey clause, hamper progress " when " the other ratepayers are practically unanimous in demand-" ing that the more modern method of illumination should " be encouraged." The other ratepayers do not know anything about it. If they did, they would be more likely to applaud the idea of the clause than to entertain the thought of encouraging electric lighting for the few at the expense of the many. This is, perhaps, progress of a kind; but it is going in a very questionable direction. Our contemporary kindly states that the clause is a powerful weapon in the hands of gas companies, " and no effort should be spared " to deprive them of it." It rests with every gas company driven to petition Parliament for the clause, to make it known in the district that the action is in the interest of the ratepayers, rich and poor, large or small. Let the history of the clause also be known—how the Bermondsey Borough Council offered to exempt the Gas Company from an electric lighting rate altogether, if they would just stand aside and abandon the other ratepayers to their fate. Let it be seen that the gas company who put forward the clause act as the South Metropolitan Company did in the first place, and are a greater protection to every ratepayer than the local authority whose duty it is to protect the public, and it would soon be decided whether the company should be deprived of this weapon of defence.

Our contemporary regrets that the supply of electricity in places where the authority are afraid of the Bermondsey clause has so largely passed out of the hands of private undertakers, but seems to be resigned to the thought that, as the local authorities have supplanted companies, the former should be left untrammelled to play ducks and drakes with the ratepayers' money, so long as the effect is to make somebody a present of electric light. This is a peculiar view, which ought to be laid before Parliament every time a Counsel asks for the Bermondsey clause. One would like to hear what Parliament would say to it. Local authorities know where gas companies are, as ratepayers, when they want money; and they cannot object to their appearing in the same capacity on other occasions.

The Privilege of Witnesses.

READERS of the newspapers a fortnight ago had a rare sensation in noting how unreservedly the Judge and one of the parties to a lawsuit denounced and vilified, by name, a person who was not before the Court, and had no connection with the case. The incident suggested some pertinent inquiries as to how the law of slander and libel affects those who make actionable statements concerning third parties in the course of their sworn testimony. Such cases must often arise, when an expert witness is being pressed to give his opinions of some person or thing bearing in a certain way upon the issue before the Court. He may aver, for example, that a machine reported to work never did work; thus reflecting upon the honour and integrity of any persons who may have been responsible for the report. The question is: Can a witness be sued for what he says in these circumstances? Oddly enough, there appears to be some doubt as to the state of the law in this regard. In the leading case of *Seaman v. Netherclift*, the defendant, an expert in handwriting, was sued for defamation of character because he declared in Court that he should always believe a certain signature to have been forged. The action was brought by the Solicitor who drew and attested the document; and the plaintiff was awarded £50 damages. There was an appeal, when the Lord Chief Justice laid it down in the broadest way that a witness is absolutely privileged in his statements, even though they be malicious. This is because it is to the public interest that a deponent should not be in the slightest degree deterred from telling the whole truth. At the same time, he added that if the witness were to say something altogether out of his character as such, or maliciously introduce something not at all pertinent to the inquiry, he might not be protected. Even then, it is not quite clear what is the proper remedy for misconduct of this kind—punishment by the Judge for contempt of Court, or by an action for defamation. No such action has ever been known. This information, interesting both for witnesses and their clients, is borrowed from the legal contributor to the " Pall Mall Gazette."

Changes in the Gaslight Headquarters' Staff.

The departmental changes which we indicated in the last issue were being made in connection with the Gaslight and Coke Company are of a more far-reaching character than was then supposed. Official intelligence on such matters does not come freely from Horseferry Road; but we believe that confidence may be placed in the following information as to the important staff changes that are about to be made—either through the completion of long terms of service or the creation of the new department referred to last week. In the first place, Mr. J. H. Pearson, the Manager of the Coke and Stores Department (who is, we believe, the oldest servant of the Company) is retiring on a pension; and to the vacant position his assistant, Mr. E. E. Rudge, is to be elevated. The assistantship passes to Mr. W. M'Dowall. Then Mr. U. Cossey, one of the two Superintendents of the Rental Department, has rendered the Company a great many years' service; and he also is retiring. The remaining Superintendent is Mr. T. H. Solomon; and it is stated that the Board have confided to him the sole control of the Department. As mentioned last week, the new department that has been decided upon by the Directors is to have entrusted to it the whole of the work connected with the supplying of gas to the public other than its actual distribution in the district. The latter is to remain the charge of Mr. G. F. L. Foulger; but the new department will deal entirely with the consumers. Over this new enterprise, a Chief Inspector is to be set; and upon him will devolve the responsibility of so ordering things that additional business is energetically sought for, and existing consumers are satisfied by receiving every reasonable consideration in connection with their varied requirements. In a district such as that of the Gaslight and Coke Company, the position will be an onerous one, calling for constant alertness on the part of the Chief Inspector; and a man smart, conscientious, and courteous will be needed to discharge the important duties. The choice of the Board (according to our information) has fallen upon Mr. F. W. Goodenough, whose present position, it is understood, is Assistant Superintendent of the Rental Department. The appointment shows a large confidence in the ability of this gentleman, as he is credited with being one of the youngest members of the headquarters' staff. He has recently had a good education in lighting methods on the Continent; the Directors having commissioned him to go abroad and report upon what is being done in several of the principal Continental cities, including Berlin. How diligently he was performing that work, intelligence reached us at the time from the Continent; but news as to what he learnt and what he saw has, it is a pity, been kept absolutely private. However, the experience then gained will without doubt be of immense value to him in his new sphere of labour, and consequently to the Company, the consumers, and the public generally. To obtain new, and retain existing, business is the work of the Chief Inspector of the Gas Business Department. His reputation hangs on the results.

Coal Markets and Foreign Gas Companies.

Occasionally at meetings of English gas companies carrying on their operations abroad, the question of the coal supply crops up; shareholders for various reasons—perhaps economical imaginations, or a doubt as to the business perception of the Board in regard to the matter, or merely for self-satisfaction—bringing the subject forward. Two instances are to be found in meetings reported last week—those of the Monte Video Gas Company and the Cape Town District Gas Company. The point, as in these cases, generally is as to whether the Directors have considered the feasibility of using local coal; and the replies in these two examples are representative of those which have time and again been given on similar occasions. They all prove this, that, taken all round, these isles are the best gas-coal producing centre the world over. To shareholders who have not been brought into immediate contact with the purchase of gas coal, it seems a senseless proceeding to pay heavy freights for the transport of coal from this country while there is coal to be had nearer the place of consumption. To most of them coal is only coal, and nothing more. Why one coal when put into a retort should not produce gas and coke in quality and quantity equal to another, is beyond their ken. So it frequently falls to Chairmen to enlighten them. In the case of the Monte Video Gas Company, tenders from other countries have convinced the Directors that they cannot do better than stick to the old country for their coal requirements; and in the instance of the Cape Town Company, it will be a matter for surprise to many others besides the shareholders to learn that coal from the Colony itself delivered on to the works costs more than the coal shipped from home. This seems an anomalous condition of things; but there is the fact. Besides, the Directors have failed to find a local coal which can compete in gas and coke producing qualities with the English material. This all goes to show the supremacy of the home article; but whether—though it may be to-day—it will be a good thing in the end for this country that there are not, for so many gas-works abroad, other equally good available fields from which present supplies can be procured at a reasonable price, is another point.

A Question of Responsibility.

There are phases connected with the modern growth and development of some of our large industries which are apt to be overlooked by those intimately concerned until someone outside calls attention to them. It has fallen upon no less a statesman and student of social problems than the Right Hon. A. J. Balfour to bring home a point of responsibility to which few have hitherto given heed. The Prime Minister was speaking to an influential gathering called together for the furtherance of the Bishop of St. Albans' scheme for the provision of churches in "London over the Border." The diocese of St. Albans contains London's greatest docks and gas-works; and in that district the various Christian denominations, it transpires, have been quite unable to cope with the growth of the population. The task the growth has imposed has completely overtaxed their financial resources. Why? was the problem the Prime Minister set himself to consider; and he believes the solution is found in two directions. First, that the development and concentration of such industries as gas-works and docks have brought about the segregation of the workers into almost distinct communities, with the consequence that those of the wealthier class who are interested in the commercial work of the country are separated so far from the workers in point of distance that their imagination is not aroused as it would be if they had under their eyes, day by day, the responsibilities which are thrown upon them by the position of those less able to aid themselves. Another cause which—however much it has benefited the great industries—has dried up the stream of beneficent charity, is that so many people now have the bulk of their property in joint-stock enterprises. This makes it appear to them that they have not responsibilities of the same kind as the individual master has towards those whom he has industrially collected about him. Yet, says the Prime Minister, it ought not to be so. It is to be hoped that his words will be the means of stirring up the consciences of the public, even though their position may only be that of shareholders, as to their responsibilities in the matter of advancing the moral and spiritual work among those who labour in such great industrial concerns as those instanced.

The Finances of Birmingham.

The City of Birmingham Blue Book, for the year from April 1, 1902, to March 31, 1903 (a copy of which we have just received), affords a clear insight into the working under existing conditions of the larger Municipalities. Mr. Thomas H. Clare, the City Treasurer, is to be complimented upon the excellent manner in which the multitudinous tables have been prepared, as well as upon the general appearance of the book, which is got up in first-class style. Some idea of the extent of the accounts may be gathered from the fact that during the year referred to the income of the city from all sources was £2,262,753, while the expenditure amounted to £2,265,015; the net capital outlay in the year being £709,314, and the gross amount of capital expended to the end of 1902-3 £16,534,455. The sum set aside during the twelve months to the various sinking funds, &c., was £183,472; while the gross amount allocated to this purpose to the end of 1902-3 (loans paid off or provided for) was £3,164,163. The balance of expenditure on capital account to March 31 remaining to be provided for—exclusive of loans raised for the Birmingham Tame and Rea District Drainage Board (£399,883) and the Guardians of the Poor of the Parish of Birmingham (£87,093), to be repaid by them—was £13,370,292, made up as follows: Borough Fund

and Rate and Improvement Rate Accounts, £2,586,402; the Dwelling-House Improvement Fund, £1,397,081; Gas Account, £1,879,041; Water Account, £6,939,841; and Electric Supply Account, £567,927. The total amount of annuities, stock, and loans outstanding at March was £15,148,078; while the total gas and electric supply reserve funds provided out of revenue amounted to £126,394. An indication of the work entailed in the preparation of the book may be gathered when it is mentioned that the figures occupy more than 250 pages; the accounts ranging from millions of pounds down to one—the Prisoners' Property Fund—in which the balance in hand at March, 1902, and carried forward twelve months later, amounted to 11s. 9d.

And the Gas and Water Works.

With regard to the gas-works, we learn that the revenue account for the year 1902-3 showed a balance of income in excess of expenditure of £178,606. After providing for annuities, dividends, interest, and sinking fund, the balance of the profit and loss account was £56,920. The amount of capital expended during the year was £64,931; the value of buildings and plant abandoned, &c., being £56,259. The total expenditure on capital account to March 31 was £2,558,969, and the amount of the reserve fund provided out of revenue (with accumulations) £100,000; while the gross amount of loans negotiated, including annuities and corporation stock, was £2,808,949. The sum provided from revenue during the year for repayment of loans and annuities was £37,159, and the gross amount carried to the sinking fund to the end of 1902-3 £679,928; the balance of loans remaining to be provided for being thus £2,129,022. The Improvement Rate accounts include £30,000 the amount of profits made by the Gas Department during the preceding year, and £4000 interest on the reserve fund. The water accounts, of course, deal with still bigger figures than these. The profit and loss account of that department for 1902-3 showed a loss of £80,039—met by transfers from the special water fund and reserve fund accounts; while the amount of capital expended during the year under the 1892 Act was £469,207, making a total capital outlay of £7,099,496. Out of revenue £50,000 was set aside for the reserve fund; and of this £43,761 has been transferred to profit and loss account. The gross amount of loans negotiated, including annuities and corporation stock, to March 31 was £7,563,186; and the sum provided during the year out of revenue for repayment of loans was £14,759. The gross amount carried to the sinking fund to March was £159,655; leaving a balance of loans remaining to be provided for of £7,400,705.

The Engineering Conference.

The second general engineering conference to be held in London, under the auspices of the Institution of Civil Engineers, takes place next week. It will be remembered that this was intended to be a biennial affair; but the Glasgow Engineering Congress intervened, and displaced the conference which was due in 1901. The programme now before us for next week does not inspire the belief that there will be any great delivery of useful technical material—anyway, so far as the Water, Sewerage, and Gas-Works Section (VI.) goes. There seems to be a temporary exhaustion just now in the gas paper line. The list for the meeting of the Institution of Gas Engineers this week lacks variety; and unless the subject of "Smoke Abatement" to be introduced for discussion by Mr. G. T. Beilby at next week's conference contains a vein of gas, then the only contribution in which gas men will be interested will be that of Dr. S. Rideal on "Coal Gas Standards." Water and sewage are represented by three subjects standing against the names of Professor Percy F. Frankland, Mr. C. W. Darley, and Mr. Percy Griffith. The meetings are arranged for Wednesday, Thursday, and Friday; but Section VI. will content itself with meeting on Thursday and Friday mornings—on the former in the Guildhall, Westminster, and on the latter at the Institution of Mechanical Engineers. On Wednesday morning, Mr. John Clarke Hawkshaw, M.A., the President of the Institution of Civil Engineers, will inaugurate the conference with a short address at the Institution of Mechanical Engineers. For the various sections there are to be a number of visits to works, and one of them will be to the East Greenwich Gas-Works of the South Metropolitan Gas Company. It should be mentioned that the Chairman of Section VI. will be Sir Alexander Binnie; the Vice-Chairmen, Mr. G. Chatterton, M.A., Mr. George F. Deacon, Mr. Walter Hunter, and Mr. Corbet Woodall; and Hon. Secretaries, Mr. E. P. Hill, Mr. G. Maxwell Lawford, and Mr. E. H. Stevenson. The Committee number 34 professional gentlemen—the bulk of whom are prominently connected with gas and water engineering. The representation on the Committee is excellent; but the support given in the production of subjects for debate has not been equivalent in strength. It is feared that the work of the section will not come up to the performance at the first conference in 1899.

Critical Councillors at Wigan

Really, the condition of mind of some town councillors is past all fathoming, and can only lead one to wonder how these individuals ever come to be elected as representatives of the majority of ratepayers who are induced to take the trouble to vote. One would have thought there could be only one opinion as to the desirability of corporations owning gas-works sending their managers up to the annual meeting of the Institution of Gas Engineers, as well as to all the gatherings of the District Association within whose area the undertaking happens to be situated. To argue that it is a waste of the ratepayers' money to give the manager leave to attend such meetings and to pay his expenses, is to say that nothing of benefit to the gas maker is to be learned from the proceedings. Yet (uncomplimentary as it is) this is the attitude taken up by a Wigan town councillor, who found fault with the decision of the Gas Committee to allow Mr. Timmins to attend this week's meeting of the Institution of Gas Engineers. The question under discussion was the appointment of an Assistant Engineer, and the councillor remarked that "they required an assistant to attend to the business at Wigan, while the Gas Engineer was away enjoying himself at the expense of the Corporation." Even this gentleman, however, felt under an obligation to produce something (no matter what) which could be said to justify his assertion; and so he took the programme, and read out the proceedings of the last day—the excursion to Eastbourne—while carefully refraining from making any reference to the business to be transacted on the days preceding. From the way in which he emphasized them, anyone not knowing better would imagine that the principal objects of the whole meeting were the luncheon in Devonshire Park and the subsequent photographing of the party. This is not the first occasion on which such a senseless quibble has been raised in the Wigan Town Council; but, for the credit of the members, it is to be devoutly hoped that it may be the last.

And at Oldham.

On quite a different plane was a discussion which took place last week in the Oldham Town Council. In this case, it was a question of jollification pure and simple, with nothing whatever but "custom" to recommend it. A new generating station is about to be opened; and the Electricity Committee, following the usual practice in such matters, decided to celebrate the occasion by a banquet. About a hundred invitations were sent out; and seemingly nothing remained but to wait patiently for the eventful day. For some reason or other, however, this proposal has proved the "last straw" to the Corporation; for, on a division, it was resolved, with only one dissentient (the Chairman of the Electricity Committee himself), that the Committee be instructed to cancel the arrangements for the banquet. This, of course, they have since done; and having lost their dinner, they have decided to abandon the whole of the proceedings in connection with the opening of the works. The very strong line which has been adopted is somewhat hard on the Committee, more especially in view of the fact that the Chairman was able to point to many previous functions having taken place of a somewhat similar character. But at the same time it cannot be denied that the Corporation are right in the attitude they have taken up. There was nothing peculiar about this particular "straw"—it merely happened to pass the breaking-point, that is all. These municipal "celebrations" are far too common, and frequently on much too grand a scale. Under the present order of things, ratepayers have enough to put up with, goodness knows, without undergoing the mortification of seeing their representatives

feasting at their expense. But henceforward, it is to be presumed, a new condition of affairs will prevail at Oldham; it is the misfortune of the Electricity Committee that they should have happened to be the first to be made to realize the fact. Due note of this warning may possibly prevent committees elsewhere from suffering a similar sad experience.

Activity at Leeds.

The Leeds Gas Committee are evidently not the sort of body to allow the grass to grow under their feet. As is reported elsewhere, they have appointed Sub-Committees to inquire into some of the most important questions which are agitating the gas industry at the present time. Foremost among these must be placed electrolysis, several clear signs of which, it seems, have lately been found in the city. No doubt, further investigation will reveal other cases; and it is to be hoped the Committee may be successful in their endeavours to find a remedy. The attainment of so desirable an object should be somewhat simplified in Leeds, inasmuch as there can be no possible question of conflicting interests—the gas-mains, water-mains, electric light cables, and electric tramways all being the property of the Corporation. The other matters under consideration are the supplying of gas for power purposes at a reduced rate and the lowering of the illuminating power, in regard to both of which it may be confidently anticipated that the Committee will adopt the views which are so rapidly gaining ground among those responsible for the supply of gas. There should in the near future be interesting developments in gas affairs at Leeds. In the meantime, it is gratifying to learn that the results of the past year's working of the department are of a satisfactory character, and that after providing for interest and sinking fund there remains a net profit of about £11,000. This, however, has been reduced to £6500 by the wiping off of the deficiency of £2000 on the previous year's accounts and the placing of £2500 to the cost of alterations and improvements at the York Street works.

Beanfeasting and Begging.

The season of beanfeasting is again upon us; and the dishonour of being one of the first to send a begging letter to gas trading firms rests with the gas office whose similarly worded circular last year commenced the campaign against this particular form of mendicancy. In this instance, those responsible for the sending out of the begging letter are hardened sinners. The words "as in former years" which follows the request for a subscription appeared in last year's letter, and goodness knows how many years running the phrase has been printed in the beanfeast circulars regularly issued from this Corporation gas office. It shows the office to be quite old hands at the game. As the general discussion of the subject (which was taken up last year at the request of certain firms trading with the gas industry) has not had the desired effect in some quarters, it is time stronger measures were taken to suppress this form of touting. It was hinted last year that, if a simple protest did not succeed, then the matter should be brought to the direct notice of committeemen, directors, and chief officers, by the publication of the circulars in full, in the hope that this would bring about the deliverance of the gas trade from the annoyance. A start may be made with the present circular. At the top of the letter paper is printed the coat-of-arms of the Borough of Stoke-on-Trent, alongside the address: "Corporation Gas-Works, Stoke-on-Trent, 25th May, 1903." Then comes the letter: "Gentlemen,—Workmen's Annual Excursion—I beg to remind you that our Workmen's Annual Excursion takes place early in June, and shall be pleased to receive a contribution from you as in former years. Annexed please find subscription form, which I should be glad if you would fill in and return to me in due course.—Yours faithfully, J. H. Hill." It is not enough to ask for a contribution, but like the begging letters of charitable institutions a subscription form is attached. Mr. Hill, too, has no intention that subscriptions shall go astray. Where the address of the contributor should appear, the form is headed "Corporation Gas-Works, Stoke-on-Trent, May, 1903;" and at the foot the address is again given: "To Mr. J. H. Hill, Gas Office, Stoke-on-Trent." Therefore it would be impossible for any philanthropic gentlemen who might fill up the form with amounts which make it worth Mr. Hill's while to have the circular printed, to send in error the "cheques" applied for to some other gas undertaking. We take it—the Corporation arms being used, and the Corporation gas office for the receipt of the contributions—that this begging circular is sent out with the cognizance of the Gas Committee and the Gas Engineer. We hope it is not. If it is, perhaps those in authority can show us some justification for permitting the continuance of this undignified system of sending the cap round to firms having business relations with the department.

An Old Agreement.

Adverting to the remark we made last week on the pleasure of sometimes being enabled to take a glance backwards at the earlier days of the gas industry, Mr. William Smith, of Ayr, has kindly given us a further opportunity of indulgence in this respect by forwarding for inspection an original agreement, partly written and partly printed, dated 1826, between the British Gaslight Company of that town, and one of their consumers. The document (which, by the way, is in an excellent state of preservation) is as follows: "Ayr, No. 117. The British Gaslight Company agree to supply Messrs. The Subscribers to the Coffee-Room with gas for three No. 1 Argands seven days a week from dark till 10 o'clock, p.m., from 29th November, 1826, to Whitsunday, 1827, for the sum of £3 19s. 10d.; one half payable at 1st August and the other half at 1st December, 1826—said gentlemen binding themselves to burn the gas agreeable to the Company's Regulation Card. Should no objections be stated within ten days from this date, the above to be binding on both parties. For said Company, William Fergusson, Gas-Work, Ayr, 6th December, 1826." The charge mentioned does not seem so high as might have been expected, considering all the circumstances; and at any rate the consumers had one advantage, in that they knew, before commencing to burn gas, exactly what was their liability. The agreement which Mr. Smith has framed throws an interesting light on the early customs of gas suppliers; and doubtless other of our readers have also preserved documents which show how different were the conditions of business in the first part of the last century from those which prevail at the present day.

In April last year the "Junior Engineers Lodge, No. 2913" was consecrated, and has since had a series of most successful meetings. The first Installation Meeting was held on Saturday at the Westminster Palace Hotel, when Bro. Percy Griffith (who has been acting as I.P.M.) was placed in the chair. Among the officers of the lodge connected with "gas," may be noted Bro. Samuel Cutler, jun., the Treasurer, and Bro. Walter T. Dunn, the Junior Warden.

In the "Journal" for the 12th ult., it was stated that the German Chemical Society had awarded to Professor Henri Moissan and Sir William Ramsay, the gold medals instituted in 1888 in commemoration of the distinguished German chemist Hofmann. They were presented last Thursday at the Hofmann Institute, in connection with the International Congress of Chemical Experts in Berlin. The President of the Society (Professor Liebermann), in making the presentation, referred to the brilliant work accomplished by the recipients of the medal, who made brief speeches in reply. The medal awarded to Sir William Ramsay bears on the obverse the effigy of Hofmann and on the reverse the inscription: "For distinguished work in the field of general chemistry, and particularly for the discovery of new ingredients of the air." The medal conferred on Professor Moissan has been awarded for distinguished works in inorganic chemistry.

In a paper by Professor Thomson, F.R.S., before the Cambridge Philosophical Society, he directed attention to the fact that when the tap water of the city is boiled, the air given off is mixed with a radio-active gas. He pointed out that the existence of the gas is easily demonstrated by electrical means, for if the air expelled by prolonged boiling from about 10 litres of water is introduced into a closed vessel, the volume of which is about 600 c.c., the amount of ionization in the vessel (as measured by the saturation current) is increased five or six times. When the water has once been well boiled, the gas expelled on any subsequent re-boiling is not appreciably radio-active. The gas can also be extracted from water at the temperature of the room by vigorously bubbling air through it. The air as it bubbles through the water gets mixed with the radio-active gas, and carries it along with it. When water which has been treated in this way is boiled, no radio-active gas is given out, nor is the gas given off when air is bubbled through water which has been well boiled. The gas extracted in this way from the water retains its radio-active properties after bubbling through strong sulphuric acid, or caustic potash after passing over red-hot copper, or through a narrow platinum tube kept at a white heat. It does not seem appreciably affected when sparks are passed through it.

WATER AFFAIRS.

The London Water Companies' Claims.

THE result of the proceedings at the first sitting of the Court of Arbitration appointed under the Metropolis Water Act, 1902, which (as we reported last week) took place on the 29th ult., was, it may be remembered, the issue of orders to the Water Companies and the District Councils concerned to send in amended statements of claim, furnishing details as to the way in which the amounts asked for the properties had been arrived at. Taking the claims in the order of their importance, that of the New River Company must be first considered. They ask for as much water stock as will produce an income of £350,000 per annum. Assuming the stock to be issued at 3 per cent., this is equal to a claim amounting to about £11,666,000, against which they have to set ordinary capital stock of £2,019,958, and preference and debenture stock of £1,940,000—together, £3,959,958. The next Company in point of importance is the East London, who claim £7,204,144; their total nominal capital being £3,771,726. The Southwark and Vauxhall come third with £5,674,140 claimed for stock and debentures of the nominal value of £3,715,517; the Lambeth following very closely with £5,511,342 and £2,247,000. The Grand Junction, Chelsea, and West Middlesex Companies claim £4,830,000, £4,750,000, and £4,200,240 respectively; the three nominal capitals being £1,685,250, £1,341,105, and £1,905,066. The only remaining Company—the Kent—ask £3,712,614 for their nominal capital of £1,210,580. The total amount claimed is, in round figures, £47,500,000, in respect of capital stock of the nominal value of £11,124,439, and debenture and preference stocks which total up to £8,711,763—together, £19,836,202. The largest amount of the two latter classes of stock is held by the Southwark and Vauxhall Company (£2,197,517); the East London standing next with £2,051,166, and the New River making a very good third with £1,940,000. The Accountants of the sellers and the buyers of these valuable properties are now engaged upon the amendment of the claims; and the above-named grand total may be reduced. But this is a possibility upon which we need not stop to speculate.

It may not be uninteresting, however, to glance back at the last occasion on which a price was put upon the undertakings of the London Water Companies with the view to their acquisition by a public body. Those of our readers who have followed the Metropolitan Water Question will recollect the circumstances under which, in the early days of 1880, the late Mr. E. J. Smith reported to the then Home Secretary—the present Viscount Cross—that he had made provisional arrangements with the Companies under which the Government would have the option of acquiring their properties compulsorily or by agreement. The purchase was to be effected by means of immediate annuities in 3½ per cent. stock issued at par, together with deferred annuities, capitalized at 3½ per cent. Mr. Smith brought out the capital value of the undertakings at £33,018,836. This figure was condemned as being something like nine millions in excess of the market value of the property at a period immediately preceding the negotiations entered into by Mr. Smith; and, in the end, the projected purchase was allowed to drop. The total share and loan capital raised by the Water Companies at the end of 1880 and up to March, 1881, as shown by Mr. Alfred Lass's first "Analysis," was £12,564,100. Then, as now, the New River Company stood first with £3,119,644; the East London coming next with £2,020,000; and the Southwark and Vauxhall, Lambeth, Grand Junction, Chelsea, West Middlesex, and Kent following with £1,790,000, £1,435,722, £1,295,500, £1,152,700, £1,045,371, and £705,163. We have thus a total of £12,564,100 then against £19,836,202 now—an increase of £7,272,102, or about 63 per cent. The amount asked for the undertakings is some 14½ millions more than Mr. Smith considered should be given for them. But in the twenty-three years which have elapsed since then they have, of course, been vastly improved; and though the Arbitrators are precluded, by the terms of the Act under which they were appointed, from taking into account "any enhancement or depreciation of the market value of any stock or shares" of any of the Companies which, in their opinion, was "caused by or resulted from the passing, or the anticipation of the passing," of the Act, they are not forbidden to make due allowance for betterment which has naturally resulted from increased business and the extension of the plant to meet it. At all events, the Companies are now fairly before the body into whose hands their property will eventually pass; and though, before this takes place, they may have to engage in some sharp contests on the subject of its value, the constitution of the tribunal who will determine this should be sufficient guarantee that the claims of both parties will have the fullest and fairest consideration.

The Water Board and the Appointment of Clerk.

WHEN the announcement was made to Mr. William Terrey, the General Manager of the Sheffield Corporation Water-Works, that he had been chosen, by a very substantial majority, to fill the position of Clerk to the Metropolitan Water Board, he appeared to be highly gratified at the result of his candidature, and left the Board-room with an expression of the hope that the choice of the members would be justified. It was therefore with considerable surprise that we learnt, from what took place at the meeting on the 29th ult., that he subsequently declined to accept the appointment, on the ground that no provision had been made for a superannuation allowance. It appears, from a statement in one of the Sheffield papers, that Mr. Terrey considered he was justified in assuming that, in the event of his election, he would come under the provisions of the Superannuation Act, 1866; and one can hardly suppose from this that the conditions submitted to the candidates contained any specific notification to the contrary. Yet in those brought up to the Board for adoption prior to the election it was stated in the most unequivocal language that the Clerk "should not, on retirement, claim or be entitled "to any pension" under the Act. How, one may well ask, did it happen that this new condition was slipped in at the eleventh hour, so to speak? It seems that the Chairman of the Committee does not know, nor does anybody else. The whole thing is involved in mystery. However, the clause gave rise to a heated discussion, with the result that it was referred back to the Committee for further consideration. Of course, Mr. Terrey was not aware of what had been going on; and he accordingly acknowledged his election unconscious that the question of the pension was in abeyance. It is a great pity that there has been this misunderstanding —"muddle" would perhaps be a more appropriate word— in connection with the appointment of Clerk. Mr. Terrey was unquestionably the very man for the position; and it has been stated on good authority that all the members of the General Purposes Committee were prepossessed in his favour. As they are reconsidering this matter, they may possibly modify the conditions to be submitted with the three names they will bring up at the meeting of the Board next Friday. Even if they should do so, Mr. Terrey can hardly allow his to be included, as last Wednesday he withdrew the resignation he had tendered to his Committee, and witnessed their expressions of satisfaction at his decision to stay in Sheffield. In any case, there must be no more uncertainty as to the terms on which the Board intend to make the appointment.

A Practical Application of the Law of Latent Heat. — An illustration of the application of scientific knowledge of the nature of specific and latent heat was mentioned by Mr. W. L. Rennoldson, the Chairman of the Newcastle Section of the Society of Chemical Industry, in his Inaugural Address. He observed that to some students the words "specific heat" and "latent heat" convey little meaning, and do not suggest useful applications. There occurred a case, however, where there was much trouble and loss going on in a factory, owing to the difficulty of cooling the gases from a furnace sufficiently to admit of the soluble portion of such hot gases being absorbed or condensed in water. It dawned at last upon somebody that, while it would not do to diminish the sensible heat of the furnace, and aërial cooling could be only very limited, it would be good to exclude as much as possible from the hot gases the constituents which possessed the greatest latent heat and specific heat. This meant the steam. The gases remaining to be cooled and condensed, while sensibly as hot as ever, would be much more easily cooled and much more thoroughly condensed without the steam. The fuel employed was coal gasified with a jet of steam through the fire. The furnace gases (products of combustion) contained a large proportion of red-hot steam, which takes enormously more cooling than red-hot carbonic acid and nitrogen. By simply substituting coke for coal, and dispensing with the steam, a great improvement was effected from every point of view.

THE

INSTITUTION OF GAS ENGINEERS.

ANNUAL MEETING, JUNE 9 TO 11, 1903.

INAUGURAL ADDRESS OF THE PRESIDENT,

Mr. ANDREW DOUGALL.

Gentlemen,—I have the honour, through no merit of my own, but by the force of circumstances, to occupy the chair on this, may I say, historic occasion. Let me first of all offer you my warmest thanks for the privilege you have conferred on me by asking me to preside over the first general meeting of the new Institution of Gas Engineers. My term of office as President of the Incorporated Gas Institute was short, but most eventful. I am very glad to think that we have seen the last of the tedious negotiations which preceded the amalgamation of the two Societies, and that we are now engaged in the responsible work of organizing our new Institution. To-day, we see many hopes fulfilled; and we stand on the threshold of a future which promises to be bright for the great and growing industry which we represent.

We must all agree that one of our first interests should be the unity of the new Institution. The very fact of our union shows that we trust and appreciate one another; and it ought not to be difficult to consolidate our common aims. But until time has helped us to forget our differences, we shall no doubt have need of patience and forbearance towards each other. Very soon, however, we shall have forgotten to which of the old Societies the various members once belonged. In the meantime, let us exercise special consideration towards one another in any little matters in which we cannot see eye to eye, and we shall be rewarded in the growing usefulness of the Institution. The negotiations of the Joint Councils, which terminated so happily in the amalgamation of the Institute and Institution, must have had a very different ending if they had not been carried on in this conciliatory spirit. It would have been unreasonable to expect that there would be no differences of opinion with regard to the many details that had to be dealt with; and it is a matter for mutual congratulation that, in spite of these differences, the spirit of harmony prevailed at the meetings. It now remains for the members generally to preserve the harmonious spirit manifested by the Joint Councils; and then I believe this Institution will have a long and honourable career of usefulness.

It has been frequently said that the negotiations of 1900 were a failure, because the goal was not then reached. But much good work was then done in arousing the attention of the members to the problem of amalgamation, and in making clear the difficulties that would have to be faced and overcome. To many of those who had been striving to attain reunion, the apparent discomfiture of their project was a bitter disappointment; and few imagined that in so short a period as that which has elapsed between that time and this, their ardent hopes would be so abundantly realized. The happy position we occupy to-day stands out in strong contrast to that in which we found ourselves three years ago, when the question of amalgamation seemed to some of us to be indefinitely postponed. There were prophets of evil then, as there always are when any important work has to be done. I have listened to many a warning from those who saw difficulties ahead; while others simply ridiculed the idea that a union of this sort could be carried through at all. That was only three years ago; and now we rejoice to know that union is an accomplished fact, in spite of all predictions of failure.

It was surprising to find how difficulties which at one time appeared to be insurmountable, disappeared altogether when fairly faced. Points of difference seemed to fall almost of their own accord into the background, and the many interests we had in common assumed more and more importance. The members of the Joint Councils approached their work with open minds, determined not to create, but to overcome difficulties; and so the goal was reached. The cares that infested that day have, to adopt Longfellow's words,

> "Folded their tents like the Arabs,
> And as silently stolen away."

The conditions of amalgamation necessarily involved changes and demanded sacrifices from some of the old members; but bearing in mind the highest interests of our Institution, I do not think better arrangements could have been made. With union as our goal, concessions, not involving the abandonment of principle, have been made; and those who, by their magnanimous action, have enabled this amalgamation to take place so pleasantly, have placed us under a debt of gratitude which we are ready, nay eager, to admit.

It is often said that "union is strength;" and to a certain extent, of course, such is the case. We must not, however, rest contented merely to have our numbers combined; for that in itself is not necessarily a source of strength. Our union means unity—unity of purpose and direction. It means the concentration of our forces for real and effective advance into the ever-widening realm of research and discovery. I am confident that, by our joint efforts, a larger sphere of usefulness for the gas industry will result. We now present a united front; and we meet to-day anticipating that, with the increase of counsel, of resource, and of zeal for our profession, we may claim our rightful place among the great Scientific Societies of our time. May we not then ask ourselves to-day, as we come together with the consciousness of the new opportunities that await us, What are we going to make of the new Institution? One of the chief objects of the Institution of Gas Engineers, as stated in the Memorandum of Association, is "To promote the advancement of the gas industry in all or any of its branches." Probably it will be more in accord with our feelings to-day if, instead of the customary review of the development of the industry with which we are concerned, we give our attention to a few ways in which I think the new Institution can fulfil its intention.

Suggestions have been made from time to time by various members as to the work that such an Institution as this should undertake; and it was my hope that the Council would have been able to formulate for discussion at this meeting a plan or scheme indicating, suggestively, the direction in which our new Society might most effectively set to work. However, there has been obviously so much to be done in other ways that it has been quite impossible for the matter to be taken up so far, though it must soon engage our most earnest attention. I have already stated that a primary interest to be cared for is the unity of this new Institution. In our Articles of Association, we have taken power to create Local Sections; and this would meet the suggestions made by more than one member that the various District Associations should be affiliated to the Parent Institution. In this way, a strong bond of union would be formed throughout the country; and the new Institution would become the centre of much usefulness.

In order to carry out such a plan, it would be necessary to have the various Sections represented on the Council of the Institution. Such an arrangement possesses many advantages. It would ensure the Council being thoroughly representative—a condition upon which the unity of the Institution so much depends; and it would keep it in touch with the work of the Local Sections. This I regard as a very important point, as the value of an Institution of this kind depends very much upon the activity of its members. On the other hand, there is always a danger of individual responsibility being weakened; and it not infrequently happens that the usefulness of such an Institution is injured by the accumulation of power in a few members. In large Institutions, it often happens that a few do all the work. It is true that such a state of things makes the responsible few more active; but it is equally true that it tends to produce indifference in the members generally, and to destroy individual action—thus creating a state of things which cannot but be attended by serious injury to the usefulness of the Institution. What is wanted is that members should be as much as possible active members. That the formation of Local Sections with representation on the Council of the Parent Institution would do much in this direction I am thoroughly convinced; and if occasionally the annual meetings were to be held in the neighbourhood of one of the Local Sections, it would stimulate and encourage the work in that particular part of the country.

Just forty years ago, the British Association of Gas Engineers and Managers was founded, and held its first general meeting in Manchester on May 11, 1864. The Association was formed "For the Encouragement and Advancement of all Matters Connected with Gas Engineering, Manufacture

and Finance," and "To Facilitate the Exchange of Information and Ideas among its Members." Such are the objects stated in the first volume of the records of the Association; and we must all agree that in those early days it did a great deal of useful work. Previous to that, the gas engineer was left to himself, without the stimulus which comes from associating with those engaged in the same pursuits. By the very nature of his calling, he was, to a certain extent, isolated, and had to combat his difficulties alone. Men, it has justly been said, can do jointly what they cannot do singly, for joint effort overcomes many difficulties; and the Association which started in those early days under the title given above, and which, in June, 1881, changed its name to "The Gas Institute," has abundantly justified its existence. We have only to refer to the reports of the proceedings at the meetings to see how the papers read and discussed have led to clearer knowledge of the subjects dealt with, and have roused the mind to new action; new subjects of thought were created, and a thirst for more technical knowledge was excited. And so the spirit of exclusiveness, which formerly characterized members of our profession, gave way with the tendency of the times to the spirit of co-operation.

Times change and require new conditions; and so, with the advent of our new Institution, we are called to consider what steps should now be taken to give it the greatest possibility of usefulness. The work of our late Societies was practically confined to the reading and discussion of papers at the annual meetings; and no doubt those gatherings, which also gave opportunities for talking matters over informally, have done much good service. Without disparaging in the smallest degree the work of the late Institute and Institution, we may reasonably expect that this amalgamation will bring fresh enthusiasm into the work of the new Society, and so enable it to take a forward movement. Now that the days of monopoly are gone, and we are confronted with strong competition in our business, it is not enough to meet once a year and discuss papers. We must see that our interests are guarded in every possible way—especially in the Bills that come before Parliament; so that the manufacture and supply of gas are not fettered or restricted. The Institute for some years engaged the services of Parliamentary Agents to watch the Bills, and report upon them to the Council; but it ceased to do so some years ago. Useful work of this kind is carried on by the Gas Companies Protection Association. "The objects of this Association are to inform the members of all proceedings in Parliament or elsewhere affecting the rights, powers, privileges, and property of gas companies, and to take such proceedings as may be necessary to secure joint action for the protection of the same." I hope, as has been suggested by Sir George Livesey, that this work will be taken up by our new Institution.

In our Memorandum of Association, it may be thought that we have been rather ambitious in respect of the powers we have taken to assist the student to a higher technical training. But even if such powers are exercised in their entirety, we shall not have done too much. Sir J. Wolfe Barry, in his address to the Association of Technical Institutions, said: "Technical education is a necessity of the time; and it is common ground that in our scientific mental equipment we are behind our two great trading competitors, America and Germany. This backwardness is due to want of information and of advocacy. We must wake up and educate, educate, educate." We may perhaps consider that the facilities now afforded to the engineering student at the various Universities and Colleges throughout the country place within his reach the opportunity to be thoroughly equipped for his vocation in life. But when such a student comes to specialize and to adopt gas engineering as his calling, the only educational advantages open to him are the classes in connection with the City and Guilds of London. These classes have done, and are still doing, good service, as many can testify. But it is a reproach to us that practically nothing has been done by our Societies for the technical training of those who desire to qualify themselves for the responsible positions of engineers and managers of gas undertakings. I trust, however, that this reproach will soon be removed and a new order of things instituted.

In this connection, we may consider a proposal that has been advocated by our Honorary Secretary for some years; and that is the establishment of experimental works and chemical laboratories. Mr. Helps referred to this at some length in his Presidential Address to the Southern District Association of Gas Engineers and Managers in 1897, and again to the late Institution of Gas Engineers in 1900. Mr. Marshall, in his Presidential Address to the same Institution in 1899, brought forward the same subject. I will quote his words: "Closely allied to the education of the gas engineer is another question I beg leave to submit to you, and that is the idea of instituting a national British gas laboratory and experimental gas-works. Our industry is perhaps one of the wealthiest, and we cannot plead want of means. At this laboratory and gas-works, students would be educated, and experiments and research in the higher branches of gas physics and chemistry be carried out, under the daily and constant direction of our ablest professors, who have made the study of gas science their own."

The possession of such valuable auxiliaries would permit us to make careful and continuous investigations in matters of which, as yet, we know but little; and by giving us more exact knowledge of the phenomena observable in our daily work, would enable us to deal with them more intelligently and more practically. At the present time, the naphthalene question is one of absorbing interest, and we are expecting more light thrown on this subject by the Committee of the Southern District Association, who, with the help of Dr. Colman, are carefully inquiring into the matter. This is the kind of work which should be carried out by such an establishment as is suggested. Again, in the days when the coal-liming process, with its extraordinary claims was brought before the gas world, it would have been a comparatively easy matter to have settled once for all the points in dispute, if the gas industry had been in possession of a laboratory and experimental gas-works. Other needful research work that could be carried on in this way will readily occur to you. Although these ideas have been frequently advocated, nothing so far has actually been attempted in the direction indicated. The time has now arrived when some action should be taken in this matter. There is an obligation—a public duty, I may say—resting upon us to see that the powers taken in our Articles of Association in this regard are not allowed to remain a dead-letter. In considering the aims and intentions of the Institution, a high ideal should be aimed at; and although it may take some time to accomplish all that we desire, we must press steadily forward in the assurance that we shall at least get nearer to the goal of our ambition.

The continued prosperity of an industry like ours largely depends upon the character of the students of to-day; and if their early enthusiasm for the profession of their choice is to be fostered and utilized, the amplest possible provision must be made for their technical education and their practical training. We must also be prepared to give them a place in our Institution, and an opportunity of manifesting their abilities and developing their talents. They should hold meetings among themselves—following the example of the graduates of the Institution of Mechanical Engineers; such meetings to be presided over by some prominent and experienced member of the Institution. If a prize were awarded for the best paper, and if that paper were published in the proceedings for the year, it would act as an incentive to study. That there is need for meetings of this kind is evident from the fact that Associations of Junior Gas Engineers are already in existence.

Mr. Joseph Tysoe, in his Presidential Address to the Southern District Association of Gas Engineers and Managers, last March, referred to the position the foreman fills in our works. He said: "It cannot be denied that efficient foremen are of the utmost importance; and by efficient I mean not only the efficiency due to a possession of the requisite knowledge of the business, but with the capacity and the desire to discriminate between right and wrong, the desire to do justice to the man as well as to the master, and the possession of tact and common sense." Well, gentlemen, I am afraid this Institution cannot do much to develop the natural qualities "of tact and common sense," which in some men are so conspicuous by their absence; but I think that it might with advantage follow the example of other countries. Germany and America have found it desirable to provide not only for the technical education of the student who some day hopes to occupy the position of engineer, but also to give instruction to the aspirant to the position of foreman and superintendent, by means of correspondence classes.

I would respectfully submit that work of this kind, expressly undertaken with a view to prepare promising em-

ployees for the position of foremen in the manufacture and distribution of gas, on the lines of the American plan, would be of immense value to the industry. Such a course of instruction by correspondence would not be open to an indictment which has been brought against the classes in gas manufacture. I have heard it said that in these classes a man may take high distinction without any practical knowledge, or even without ever having been inside a gas-works. On the contrary, this instruction would be given to those who were actively engaged in the work of gas making, or in the distribution department. The course should be of a special character, calculated to qualify for these particular appointments, and not for the higher branches of the profession. The distribution of gas is a work of increasing importance; and if the foreman or superintendent is to carry out his duties intelligently and successfully, he should be thoroughly acquainted with the merits of gas as compared with electricity, not only for lighting, but for heating and motive purposes. The man who understands the significance of what he sees happening around him, who can give the reason for what he does, and can explain the changes which take place under his eyes—in short, who does not work by rule of thumb, but can see things in their true light—such a man will find his occupation full of interest, and will work more effectively and cheerfully.

In the "Review of Reviews" last year, there appeared an article on "Tapping the Brains of Labour," showing how remarkably successful the system of offering prizes for suggestions made by the workmen had been in an establishment in America. The system is not altogether unknown in the gas-works of this country; for I understand that the South Metropolitan Gas Company have for years recognized the benefit of this plan, by rewarding their workmen for suggestions that tend to greater efficiency in the working. Now, if this Institution moves in the way indicated for the benefit of aspirants to the positions of foremen, by providing a course of instruction calculated to inform them of the salient facts of their business, a system could be devised by which the Institution might receive suggestions from foremen on improvements in the methods of doing their work. Closer co-operation in the management of gas undertakings is, in my judgment, possible as well as desirable; and by this means we should be able to extend to smaller undertakings the benefits that accrue to larger concerns.

If such an arrangement were carried out, the best suggestions might be published, with the names and addresses of the prize winners. It would also be necessary to put in conspicuous places on our works notices giving full information of the system, with the address to which the suggestions should be sent; and it should be stated that the scheme has the hearty support of the company or corporation, as well as that of the engineer. Any suggestions of value would be circulated among the members, as is the case with the information obtained by the reading and discussion of papers. A scheme of this kind must be calculated to increase the intelligent interest of those taking part in it, and to concentrate their attention upon the most important points of their work. It would give them an opportunity of distinguishing themselves, and they would gain any credit that was due to them. It must be self-evident that anything that is done to raise the efficiency of those engaged in any gas undertaking must tend to the prosperity of the undertaking itself; and proprietors should not hesitate to lend their liberal support to such an educational scheme. I see we have 677 members of this Institution (not including those who will be elected at this meeting), representing 430 gas undertakings. If we divide these into classes according to their size, and ask them to contribute proportionately, we should, I feel sure, receive enough money to establish in connection with our Institution a Technical Department, the advantages of which it is hardly possible to over-estimate.

The new Institution will inherit from the late Institute a library of many volumes. These have seldom been consulted in the past, owing probably to the fact that they could not be taken away. Could we not turn them to better account now by making the library a circulating one? Our younger members especially might be glad of the privilege of consulting these on payment of the expenses of postage. I think the idea is worth our consideration. It has been said that the future of the gas industry depends very largely upon the engineers engaged in it. That I thoroughly endorse; but I would like to draw attention to the fact that in large measure the position which the gas industry will occupy in the future depends upon the directors of gas companies and the corporations owning gas undertakings. In a comparatively short time (for with most of us the years speed swiftly) the day will come when we must give place to younger men. We realize this more and more as it grows clearer to us that life is all too short to complete our cherished plans; and the question naturally arises, Is the class of men being attracted to the profession who will be able not only to maintain its present position of usefulness, but to raise it to the higher and more prosperous condition which it should occupy?

We are told that knowledge is wealth, and that the more thorough the training a young man has, the higher will be the position he ultimately attains. Certainly, he who has the better training usually rises the more rapidly and easily to eminence; but he will not be attracted to a profession that does not offer a prospect of adequate emolument. I do not hesitate to say that many owners of gas undertakings, by reason of their parsimony in the remuneration of their engineers, are failing to attract the right class of men. It should not be, as is so often the case, a question of supply and demand. The owners of gas undertakings, by dealing liberally with their responsible officers, should encourage the most capable of the budding engineers to enter our profession. I make bold to say that the best of such men will not be attracted to gas engineering so long as small and inadequate salaries are paid.

Many a young man of good ability and education has to work for years at a "salary" that would be paid as "wages" to an ordinary mechanic, and has only a very moderate competence to look forward to in the future. Such a state of affairs should not exist; it is an unwise policy which has not the excuse of lack of funds to justify it. A more generous spirit must be shown if the best men are to be encouraged to enter our profession. This is a serious matter, as it threatens not only to lower the status of gas engineering, but to affect adversely the progress of the industry. The requirements of the gas engineer of the future will be greater and more manifold and diversified than those of the present day, and the authorities who have the direction of gas undertakings have in this respect a serious responsibility resting upon them which they too seldom realize. Some companies have already realized this, and find advantage in it.

Well, gentlemen, I have touched upon several ways in which this Institution might do useful work, and perhaps it would be well if I now enumerate the suggestions in order:—

1.—Affiliation of the District Associations, with representation on the Council.
2.—Carrying on the work of the Gas Companies Protection Association.
3.—Establishment of experimental works and chemical laboratories.
4.—Meetings for students.
5.—Course of instructions for employees.
6.—Prizes for suggestions from foremen.
7.—Circulating library.

I am optimistic enough to believe that in time some such ideas as these will be carried out by this Institution. It must necessarily be some time before we can have experimental works and chemical laboratories established; but I see no reason why the other suggestions should not be carried out soon, if they meet with the approval of the members generally. We cannot be expected to supply the funds to carry on this work ourselves; and we must rely in great measure upon the support of gas companies and corporations owning gas undertakings, who will receive the ultimate benefit. In order to increase the interest of these, I would suggest that the chairman of each board subscribing should be invited to attend the annual meetings of the Institution. In this way their interest would be quickened, and I am sure we should gain their liberal support.

The late Mr. W. R. Chester, in his Presidential Address to the Gas Institute in the year 1896, gave a clear and complete account of the history of the Benevolent Fund of the Incorporated Gas Institute. I do not wish to traverse that ground again; but I do want to make a strong appeal for greater and more generous support to this fund, which renders such valuable help to necessitous members and their families, and which I trust will be administered in future by this Institution. I fear, however, owing to the

amalgamation, it will lose many subscribers who are no longer of our number. The Benevolent Fund did not in the past receive from the members of the Gas Institute the general and generous support which it deserved. Last year, out of a membership of 672, only 93 subscribed. This seems to be a very fitting opportunity to bring the matter before the members of the new Institution, and I venture to appeal for subscriptions so that we may have a Benevolent Fund worthy of ourselves, and equal to the claims that may be legitimately made upon it.

It is now 100 years since gas was introduced—at first for lighting only and at a high price, making it the possession of the rich. The history of the industry is one of continuous progress; processes for the more economical production having been invented from time to time. Gas is to-day more popular than at any former period; the many ways in which it can be conveniently applied for the requirements of every-day life rendering it a most indispensable servant. The growth of the Company with which I am connected (formed in 1843) will serve as an example of the way in which the demand for gas has increased in a purely residential district.

Ten Years Ending.	Total Gas Sold. (Thousands.)	Price of Gas.	Increase in Consumption Ten Years. (Thousands.)	Candle-Hours for a Penny.	Remarks.
—	—	12/6	—	14	Co. founded 1843
1852	7,893	6/	7,893	28	Ordinary burner
1862	18,945	5/10	11,052	35	,, ,,
1872	45,319	4/6	26,374	55	,, ,,
1882	99,995	3 9	54,476	72	,, ,,
1892	160,560	3/3	60,765	155	Regenerative ,,
				500	"C" Incan. ,,
1902	238,018	3/	77,458	700	Kern ,,
				950	Intensified ,,

In the year 1895, the electric light undertaking of the Tunbridge Wells Corporation was inaugurated.

It will be seen that, as the sale of gas increased, the price, as a natural sequence, steadily decreased; and with the advent of improved burners to develop the lighting power of the gas, great progress has been made towards supplying the public with cheap light—a progress which can hardly be equalled in any other commodity devised for the service of man. This advance has been made in spite of all the restrictions placed upon gas undertakings by the watchful eye of the British Parliament, which, with a view to the protection of the public, fettered the production of gas with conditions with which it was most difficult to comply. These obstacles to the progress of the industry were not allowed to damp the enthusiasm of those engaged in the profession; and although often felt to be harassing and inimical to success, they were accepted as a necessary condition of a monopoly. Now, however, that such a monopoly does not exist, and the public are free to choose gas or electricity, these restrictions are no longer called for. The requirements of the public are rapidly changing, and we must alter the character of our gas and our conditions of supply to meet these requirements.

We are now engaged in active competition with electricity for lighting purposes, and with fuel gas for heating and motive power. This is a healthy sign, for easy employment will never help us to develop our best faculties, and this competition on both sides will I am convinced bring out the highest powers of those engaged in it. Work which does not tax to the full our skill and intellectual power, and present obstacles requiring concentration of thought to overcome them, is not conducive to energy of purpose. Difficulties sometimes come to us as blessings in disguise. Great as has been the growth of the industry in the past, there is still a much larger field for it to occupy in the future; and a rich harvest awaits us when all the energies of gas are utilized for the welfare of mankind. Gas, when used in the Welsbach burner, is beyond doubt vastly cheaper than electricity; and the hygienic conditions under this system are in favour of gas. The convenience of the electric light, and its adaptability to decorative effect, charms many a consumer and leads him to adopt it. Surely, however, with an article which is so greatly superior in every other way, the inventive mind will find fruitful employment, and not be slow to produce conditions of lighting by gas that cannot be excelled or even equalled by its daring electric competitor.

The lighting of our streets and thoroughfares by the Welsbach burner and the intensified light is rapidly being recognized as greatly superior in every way to the forms of electric lighting with which we are familiar. Public authorities who are responsible for the lighting of our streets are beginning to realize this fact, and gas is growing in favour. Fashion, too, is changing in the choice of an illuminant for lighting shops, places of business, factories, &c.; and those who, with the advent of the new light, wished to be regarded as up to date and rushed for an installation of electricity, are now entranced with their old love—brilliant and irresistible in the garb of the incandescent mantle in which Solomon's Palaces were never arrayed. The question of price has been settled by the severe test of experience, and the hygienic claim of electricity has been proved to be nothing more than a myth. What is wanted now is that the claims of gas, compared with electricity, should be brought before the public with all the intelligence at our command.

The field open for the supply of gas for cooking, heating, and motive power, and remaining still unoccupied, is very great. It is by the employment of gas instead of solid fuel that our towns and cities are to become smokeless. The possibilities for the use of gas in this direction are endless in their varieties of application. The development of large gas-engines to take the place of steam-engines, and the general employment of gas-motors, would considerably extend the field. Much progress has been made lately in this direction; and the ease with which large gas-engines can now be started and shut off, brings them increasingly into favour. The competition arising from fuel gas, which necessitates the erection of special plant not only for the production of gas, but for the recovery of ammonia, can only be limited in scope. The expenditure of capital, and the trouble of working such plants under varying conditions, are unfavourable to the general adoption of such gas in preference to that supplied by gas companies. Again, when we consider the extent to which gas is now used for a variety of purposes in our homes and in trade, we must be conscious of the change which is rapidly coming over our industry, requiring a new condition of affairs to meet the public need. The old order of things which called only for gas of high illuminating power is passing away, and we shall soon be required to supply gas of lower illuminating power and good calorific value. The calorimeter will then largely take the place of the photometer in estimating the value of the gas.

The time has arrived when companies must not only furnish an uninterrupted supply of gas to the meter, but keep the internal fittings free from obstruction, and undertake the supervision of all appliances for the use of gas. Those who have adopted the maintenance system in connection with incandescent burners know how generally this service has been appreciated by the consumers, and how very much it has added to the popularity of the light. The Tunbridge Wells Gas Company have found the system to be a great success, and have applied it not only to incandescent burners, but to fires and cooking stoves. Fitters inspect and clean all fires and cooking stoves at stated intervals, cleaning and adjusting the burners and renewing defective parts. This systematic visitation, keeping fires and cooking stoves in good working order, has added greatly to the popular appreciation of gas for such purposes. It has greatly reduced the number of complaints that come in daily; and surely that must be to the advantage alike of the consumer and the Company. Fires and cooking stoves should be easily taken to pieces *in situ* to be cleaned, and to have any defective parts readily renewed. Makers have not been slow to recognize this necessity; and they are placing on the market appliances suitable for the purpose. This maintenance system is rendered doubly necessary where gas is used under the coin-meter system, and where all the pipes, fittings, cookers, &c., belong to the company. The visits from inspectors often lead to more intelligent use of these. I am a strong advocate for periodical inspection of this kind.

There is just another point that I should like to draw attention to. In the building of new houses there is a disposition to wire them for electricity, and to ignore gas entirely for lighting purposes. The difficulty of piping a house for gas after it has been built and decorated is often so great that a tenant will hesitate to make the change, however dissatisfied he may be with the electric light. To meet such a state of affairs, the Tunbridge Wells Gas Company undertake the piping of houses for gas at cost price.

In this way, we have no difficulty in getting an entrance into new houses that are being wired for the electric light, and the tenant then has the option of using one or the other. Our great dramatist has well said:

> There is a tide in the affairs of men,
> Which, taken at the flood, leads on to fortune;
> Omitted, all the voyage of their life
> Is bound in shallows and in miseries.
> On such a full sea are we now afloat;
> And we must take the current when it serves,
> Or lose our ventures.

For some years past, our "friend in disguise," the electric light, has been haunting the minds of many; but its present commercial status, as shown in the Parliamentary Returns, reduces it to a phantom. We owe it our thanks for the stimulus it has imparted to our profession, and the demand it has created for "more light." The incandescent mantle has revolutionized the mode of the application of gas for illuminating purposes, enabling it to rise, Phœnix-like, far ahead of all its competitors; the efficiency and economy of this system having effected the paradox of reducing the consumption and cost on the one hand, while it has increased the consumption, by creating a larger demand for "more light," on the other. So the old order of the way of using gas gives place to the new, giving rise at the same time to the "new order of things" in the legal standards by which its supply is regulated. Parliament is rousing from its long stage of lethargy; and fetters which have so long bound the commercial action of the profession are loosening, as is shown by the recent action of the House of Commons Committee in the case of the Crystal Palace District Gas Company's Bill, now before Parliament, which may truly be described as "epoch making."

So, with the passing away of the old disunited Societies, there pass away the old phantoms and impediments; and with this new Institution of Gas Engineers, possessing increased strength born of unity and concord, concentration of mind and effort, there dawns a day of opportunity and of service, which should be a stimulus to every member of the Institution of whatever rank or position, and thus enable us to adapt once again our great bard's expression and say:

> Come the three corners of the world in arms,
> And we shall shock them. Naught shall make us rue,
> If "this Institution" to itself do "prove" but true.

International Committee on Photometry.—We learn from M. Ph. Delahaye, the General Secretary of the Committee, that at the forthcoming meeting in Zürich a paper descriptive of "Two Methods of Determining the Illuminating Power of Incandescent Burners of Ordinary and High Intensities" will be presented by Messrs. Charles Carpenter and J. W. Helps.

The "Selas" System of Lighting.—Through the courtesy of the Directors and officials of the Gaslight and Coke Company, members of the Institution of Gas Engineers will be accorded an opportunity of seeing an installation of this system, which is described in the paper by Mr. F. D. Marshall, in operation at the offices of the Company at Horseferry Road, Westminster.

The Rusting of Iron.—At a recent meeting of the Chemical Society, the subject of the chemical reactions involved in the rusting of iron was introduced in a note by Professor W. R. Dunstan, F.R.S. He showed that the presence of liquid water and oxygen is necessary for the formation of iron rust, and that this action is merely accelerated, not conditioned, by the presence of carbon dioxide. No rusting occurs when pure iron is kept in the presence of oxygen and water vapour at constant temperature. Rusting is prevented by the presence of solutions of such salts as decompose hydrogen peroxide; while its formation is not inhibited in solutions of salts in the presence of which hydrogen peroxide is stable. The deduction is therefore drawn that hydrogen peroxide is the active agent in the production of iron rust.

Standardization of Pipe-Flanges.—A Committee dealing with this question has been formed in connection with the Engineering Standards Committee, to which reference has already been made in the "JOURNAL." Mr. W. H. Maw, who was President of the Institution of Mechanical Engineers when the subject was discussed before that Institution, is Chairman of the Committee. The Admiralty have appointed Engineer-Lieutenant A. R. Emdin, R.N., and Mr. W. E. Smith, the Superintendent of Construction Accounts and Contract Work. The Institution of Mechanical Engineers have nominated Mr. Ellington and Mr. H. Davey; the Institution of Electrical Engineers, Mr. Patchell; the North-East Coast Institution of Engineers and Shipbuilders, Mr. J. Tweedy; and the Institution of Engineers and Shipbuilders in Scotland, Mr. John Steven. The following gentlemen have also seats on the Committee: Mr. R. E. Atkinson, Mr. J. Dewrance, and Mr. J. Hopkinson.

ESSAYS AND REVIEWS.

CONCENTRATING GAS MANUFACTURE IN NEW YORK.

A Mammoth Works Scheme.

To see, to inquire into, and ultimately, for his own purposes, to pronounce judgment upon, examples of the best gas work, plant, and apparatus that is to be seen in this country and on the Continent, is the present large mission of Mr. W. H. Bradley, the Chief Engineer of the Consolidated Gas Company of New York; but as time presses—he having much work to which he has set his hand engaging his attention—he has had to carefully map out and compress his course of inspection in order to be in New York again at the earliest possible date. However, from a little conversation which the visit has given us the pleasurable opportunity of having with him, it may be predicted that his professional doings in the next few years will have something more than an ordinary interest for his colleagues on this side of the Atlantic. The work Mr. Bradley has before him has for the end of the first stage the concentration of the whole of the gas supply of his Company upon a new site; and his plans are being so laid that that site may eventually be the producing centre, should occasion demand, of a daily output of no less than 240 million cubic feet of gas per day. This is an astounding figure; and how many years the Company are from seeing within view the actual climax of these liberal preparations, no one can, of course, compute. The figure, however, has an inspiring interest. It tells eloquently of how in go-ahead New York, where from afar one pictures electricity dominating almost everything, the leaders of the gas industry have an unbounded faith in the prospective progress of the commodity they dispense. Mr. Bradley is accustomed to dealing with big figures and to giving thought to the future; and he does not look upon the eventual complete occupation of the new site as being something beyond the contemplation of to-day.

The large Company which it is Mr. Bradley's honour to serve was formed, as many readers know, by the consolidation of the interests of six Companies, who had between them at the time seven manufacturing stations. One of the stations has since been discontinued; and from the remaining six the Consolidated Company to-day meet the needs of their numerous consumers. In addition to this, three other Companies are manufacturing and distributing gas in the same territory. The whole of these works are situated on Manhattan Island—that is to say, the old City of New York before the development of Greater New York. Of the Consolidated Company's six stations, three are making water gas exclusively, and are sending out a total of some 34 million cubic feet a day. At the others, coal gas is produced, to the extent of between 14 and 20 millions a day; so that in all the Company's maximum daily output at this time may be taken as about 50 millions. The other three Companies produce water gas exclusively, and have an output of about 26 millions; the aggregate of all being at present about 80 million cubic feet per day. The concentrating scheme contemplates the abandonment of all these stations, so that no gas will be manufactured on Manhattan Island. Under such circumstances as these, Mr. Bradley has upon his shoulders a vast responsibility; and in the present interesting stage of retort-house progress, and with new claimants in the field, it will be a matter of curiosity to see the lines on which he will, in the immediate future, lay his plans for the first sections of his new carbonizing works. From this, it will be remarked that the work of construction so far as the main plant is concerned has not yet been entered upon.

However, the site has been secured, general plans have been formed, tenders for large portions of apparatus have been let, and works incident to the future development and service to and from the works are in hand. And so it may interest to give at once, from the facts gathered in the course of the conversation with Mr. Bradley, some further indication of the magnitude of the scheme. Later, when he has consummated his projects for the first section, he has kindly promised to send for publication in the "JOURNAL" a description of, and drawings showing, the completed arrangements. The new site is on Long Island, at what is known as Lawrence's Point, a little above Astoria. Those who are acquainted with New York City will locate the site better perhaps if it is mentioned that it lies almost opposite 125th Street. The site is a tract of land measuring something like 300 acres. It is property that has never been built upon to any extent; and it is fairly good ground for its destined purpose. Conditional on the engineering and scientific developments of the future, and on what may transpire in connection with the markets for raw materials, the idea of to-day is to evolve the works on the lines of an equality in proportion in production of coal gas and water gas—50 per cent. of each. The construction of the works immediately contemplated will, of course, occupy some years; and the developments that may take place in one or the other system of manufacture may consequently have an effect in changing the proportions. However, as already said, the site, as at present plotted, will, if necessary, eventually accommodate plant equal to an output of 240 million cubic feet of gas.

The first section of the works will be a coal-gas plant of

20 million cubic feet capacity; and it is just possible, Mr. Bradley tells us, that the Company may build two sections right away, with (together) a manufacturing capacity of 40 millions. As a matter of fact, the contracts are already let for the first 20 million section, so far as the purifiers, washers, condensers, meters, and all the various apparatus that go to make up a section of plant are concerned other than that for carbonization. It is on this point of carbonization that a little uncertainty exists in Mr. Bradley's mind; and in it is found the main object of his mission. So far as he has seen and his inquiries have proceeded, he has not yet fully satisfied himself as to whether inclined or horizontal retorts should have preference. He left America feeling that his best course would be to construct the first section partly of horizontals and partly of inclines, and so settle their relative merits side by side, and under equal conditions, on his own account. He believes that he will return possessed of the same view; but whether the visit he is now making to the Continent will influence him one way or the other, of course we cannot say. He came here with a perfectly open mind; and his confession that the visit to this country has not as yet influenced a balance in favour of one method over the other, carries with it a little latent criticism. While it would have been interesting to have had them, he is not here for the purpose of publishing his impressions—more especially as he may still prefer to leave his final judgment to the personal practical test to which he inclined before he embarked on the *Umbria* a few weeks since. Therefore, for a knowledge of his views on this particular matter, we must abide for a time.

To proceed, Mr. Bradley's plans comprehend the construction of a gasholder which will place the 12 million cubic feet East Greenwich holder in the second position in the world in point of capacity. The first one which is to be constructed on the Long Island site is projected for the accommodation of 15 million cubic feet of gas, though further consideration may produce some modification. But the capacity mentioned represents present intentions; and the addition beyond the East Greenwich structure marks a considerable flight in gasholder engineering. Then before Mr. Bradley left America, a contract was entered into for the construction of large docks on the new site; and these have since been commenced. A contract has also been let for 2½ miles of 60-inch diameter steel gas-main; and the work is being proceeded with now in order that the main may be well ahead of the other work, and in readiness for the conveyance of gas from the new works directly production begins. Steps have also been taken to secure permission to construct a tunnel, under the mouth of the East River, direct between the new property and Manhattan Island. This tunnel (which will probably be constructed entirely through rock) will be about 6400 feet long, or a little less than 1¼ miles. The depth of water at the parts where it would cross vary from 40 to 70 feet; and a minimum covering of at least 20 to 30 feet of rock will be required. These few particulars show generally the stupendous nature of the work in hand and in prospect.

Before closing these notes, there is one point which our chat with Mr. Bradley on his projects called up, and which, although having only an indirect bearing on the latter, may be mentioned. It occurred when referring to his intentions—existing conditions continuing to prevail—to construct the works with equal producing proportions of coal gas and water gas. He admits that coal-gas manufacturing operations in America have to some extent had a set-back through the large adoption of water gas. But there are signs, he says, that coal gas will in the near future receive a larger amount of consideration, though carburetted water gas, under present circumstances, will continue to be indispensable. It was the occurrence some years since of cheaper petroleum products and anthracite coal (which is used to a greater extent than coke for the purpose in America) that stimulated the production of carburetted water gas to the detriment of coal gas; and one of the reasons for its continued prevalence is that the requirements of the United States in regard to candle power are higher than obtain in England, and water gas can be made, at a less cost, of a higher illuminating quality than coal gas. Water gas is produced there up to 25 or 26 candle power perfectly, and without any trouble either to the maker or the consumer, while coal gas of that quality would be (as Mr. Bradley puts it) "very smoky and red." Therefore, he adds, "as we are compelled to make gas of from 22 to 26 candle power, water gas helps us out very freely; and unless the standard of candle power is lowered, we shall be practically obliged to use some proportion of water gas to maintain the quality." But, at the same time, Mr. Bradley is not a believer in the supply of gas of such high illuminating power; for he dismissed the subject with the remark: "I wish the people in the States would turn their attention to getting the candle power down as is being done on this side. In my opinion, it would be a very sensible move in these days of incandescent gas lighting and cooking and heating by gas."

In the indefinite state of the final plans, the few notes we have given on this large gas-works concentration scheme for New York must for the present suffice. They show the importance and extensive character of the work that has devolved upon Mr. Bradley, and the perfecting of which (although he talks very modestly of what is before him) he has deeply at heart. No man, it can be said without fear of contradiction, has ever had the opportunity, after so many years' service in the gas industry as Mr. Bradley can number, of setting himself to the projecting of a new scheme such as this; and it will form a splendid crown to his long and honourable professional career.

PERSONAL.

As mentioned towards the close of the notice which appears elsewhere of the recent visit of the Junior Institution of Engineers to Staines, Mr. Samuel Cutler, jun., has been elected Vice-Chairman of the Institution.

Mr. J. C. Hawkins has lately tendered the resignation of his position as Assistant-Engineer of the Torquay Water-Works, having accepted a similar position at Port Elizabeth, under Mr. W. Ingham, who, it may be remembered, a short time ago, relinquished the engineership at Torquay.

It will be learned with great regret that Mr. A. MacPherson, Engineer and Manager of the Kirkcaldy Gas Company, has been obliged, on account of the state of his health, to resign his post. He has not been well for about six months, being troubled with insomnia. His resignation was laid before the Directors of the Company on the 28th ult., and was accepted—a retiring allowance being granted to him. He has been a most successful Manager; his chief distinction being the remarkable skill with which he held the balance evenly between the Company and the consumers.

At their meeting last Thursday, the Directors of the Kingston-upon-Thames Gas Company appointed Mr. H. W. Packham Engineer and Manager of the Company, in succession to his father, whose death was noticed in the "Journal" for the 26th ult. The new Engineer has been associated with the works since 1887. He was articled both to the late Mr. Packham and to the Company, and therefore could not have received better training than that which his father gave him. During his connection with the Company, two gasholders have been erected, retort-houses and purifiers constructed, and water-gas plant installed. In 1892 he was appointed Assistant-Manager to the Company. He is in his 34th year, and thus succeeds to the responsible position of Engineer when he has abundant vigour to apply to the duties. Mr. Packham is an associate member of the Institution of Gas Engineers, and a member of the Southern District Association of Gas Engineers and Managers.

We are sorry to learn that, owing to the state of his health, Mr. H. Leicester Greville, F.I.C., F.C.S., has resigned the position of Chemist to the Commercial Gas Company, which he has held for some time. He has been suffering from heart failures; but we are pleased to hear that he is now well again, after a prolonged rest. Mr. Greville is succeeded by Mr. H. F. Hills, F.C.S., an Assistant to Professor Lewes, who has been associated with him, and whose name may be remembered by some of our readers in connection with his book on "Gas and Gas-Fittings," which was a reprint of a series of articles he contributed to the "Students' Column" of the "Builder." We understand that Mr. Greville will continue private practice. As the change he has made will give him greater leisure for the pursuit of investigations which possibly only lack of opportunity has hitherto prevented him from carrying out, we venture to hope that his name will appear more frequently than it has done of late as a contributor to our columns. We are encouraged to do so by the circumstance that an article by him, dealing with the use of gas liquor in the purification of water gas, is given in another part of the present issue.

OBITUARY.

Northampton has lately lost a highly respected citizen by the death, a few days ago, of Mr. Frederick Muscott. Deceased was Chairman of the Northampton and Weedon Gas Companies, and he filled a similar position in the Northampton Water Company till the undertaking was acquired by the Corporation. He was also connected with the old Kettering Water Company. He was in his 77th year.

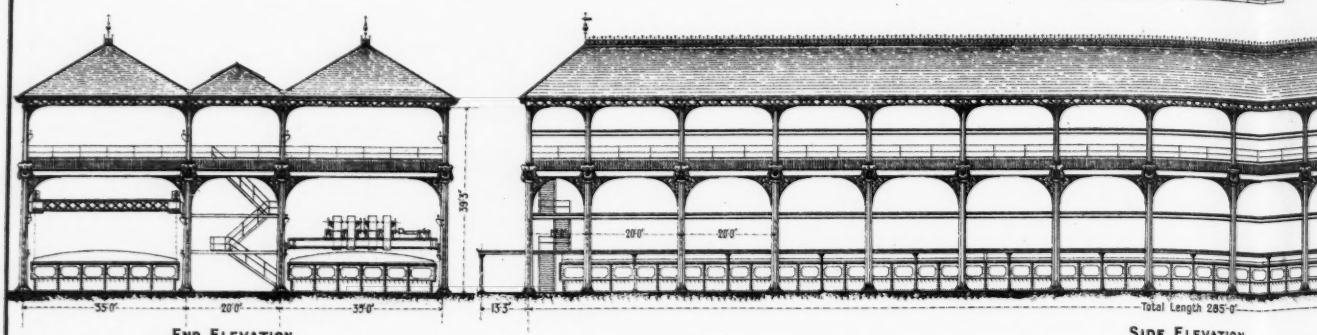
The death occurred a few days ago of Mr. Thomas Cook, a member of the firm of Messrs. Robinson, Cook, and Co., of St. Helens. Deceased had taken a leading part in the affairs of the town since 1876, when he first became a member of the Corporation. He served on all the most important Committees of the Council; but it was as Chairman of the Gas Committee for 24 years that he rendered most signal service. He was an Alderman of the borough, and had filled the office of Mayor.

The Sutton Water Company have sustained a serious loss in the death of their Chairman, Sir Allen Lanyon Sarle, J.P., which took place at his residence at Banstead early on Friday. The deceased gentleman was instrumental in starting the Company, and was one of, we believe, the only two original promoters left. He was appointed Auditor on June 24, 1864, and acted in that capacity until he was elected a Director on Aug. 16, 1870. Twelve months later he became Chairman; and he had therefore discharged the duties of the position for nearly 32 years. He always devoted much time and attention to the undertaking; and almost his last public appearance was in the Committee-room of the House of Commons not many weeks ago, when the Company's Bill for an extension of powers was passed. Sir Allen was 75 years of age.

The Granton Works of the Edinburgh

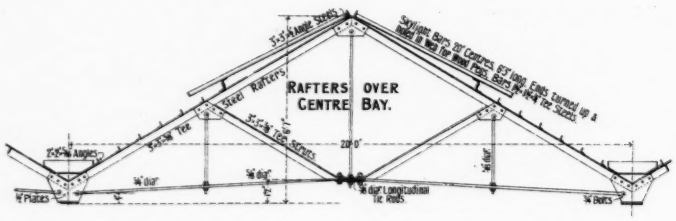
Purifying Plant House and Details of t

PURIFYING PLANT HOUSE.



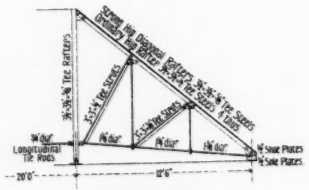
END ELEVATION.

SIDE ELEVATION.

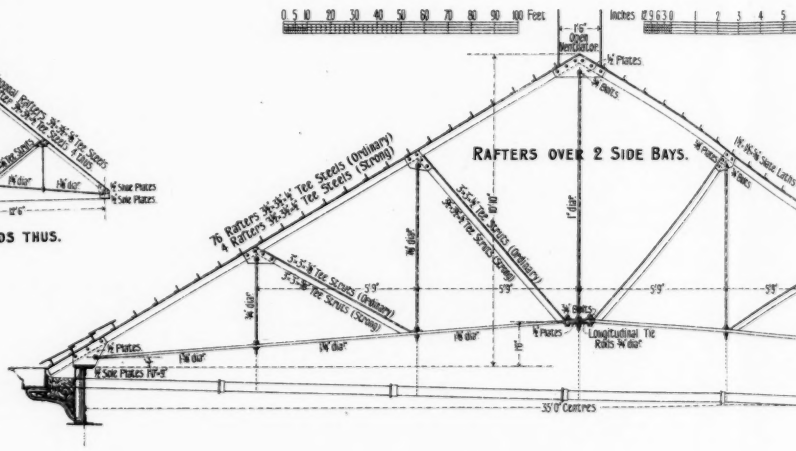

RAFTERS OVER CENTRE BAY.
Steel Rafters
Skylight Bars, 20' Centres, 6'3" High, Ends Turned up & Rivetted to Wall Plate, Bars 3"x3"x⅜" Tee Steels
3"x3"x⅜" Tee
3"x3"x⅜" Angles
¾" Plates
¾" diar
Longitudinal Tie Rods

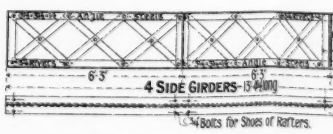
DETAILS OF ROOFS FOR PURIFYING PLANT HOUSE.

2 HIP END RAFTERS.

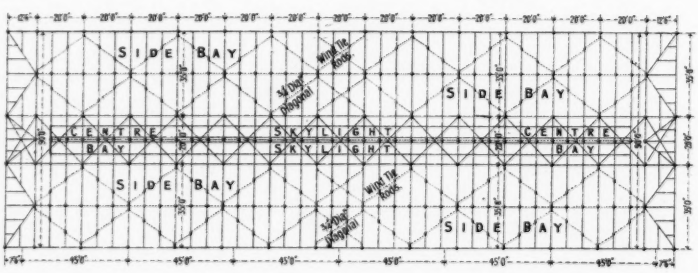


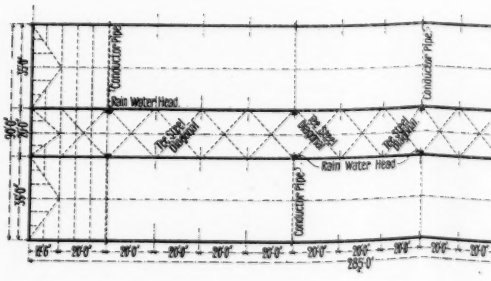
4 HIP ENDS THUS.


0 5 10 20 30 40 50 60 70 80 90 100 Feet
Inches 12 9 6 3 0 1 2 3 4 5
6"6" Open Ventilator
¾" Plates
¾" Bolts
RAFTERS OVER 2 SIDE BAYS.
76 Rafters 3"x3"x⅜" Tee Steels (Ordinary)
4 Rafters 3"x3"x⅜" Tee Steels (Strong)
3"x3"x⅜" Tee Steels (Ordinary)
3"x3"x⅜" Tee Steels (Strong)
3"x3"x⅜" Tee Steels (Ordinary)
3"x3"x⅜" Tee Steels (Strong)
¾" diar
5'9"
¾" Side Plates 10'-0"
Longitudinal Tie Rods ¾" diar
35'0" Centres



NOTE-Holes in Bottom Flanges
to suit those in Column





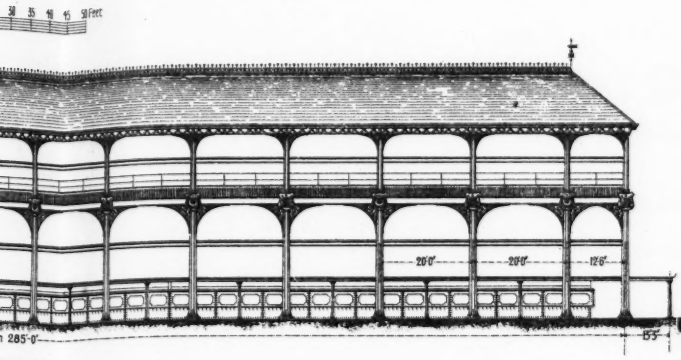
Copyright at Stationers' Hall.

nburgh and Leith Gas Commissioners.

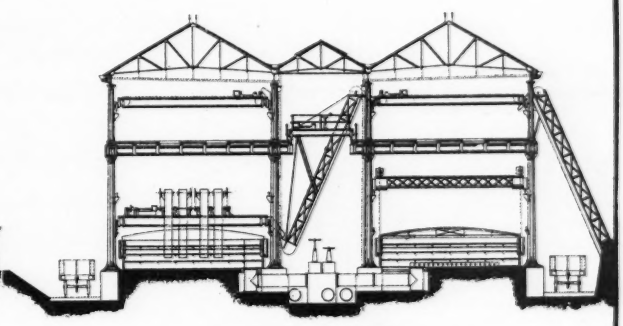
etails of the Roof-Trusses and Girders.

No. 23.

NT HOUSE.



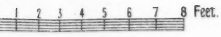
EVATION.



TRANSVERSE SECTION.

ROOF GIRDERS FOR PURIFYING PLANT HOUSE.

PLANT HOUSE.



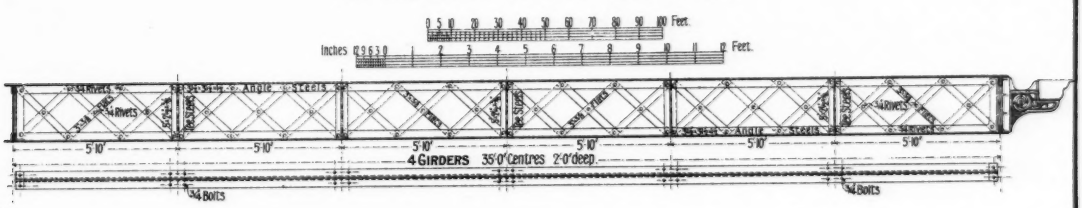
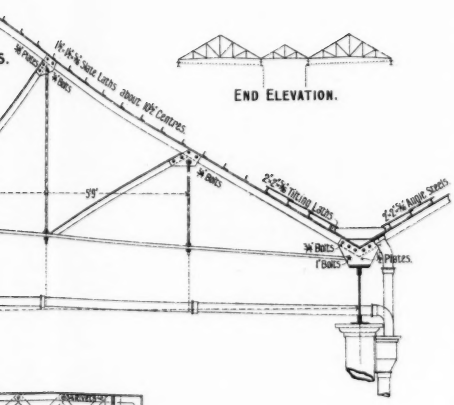
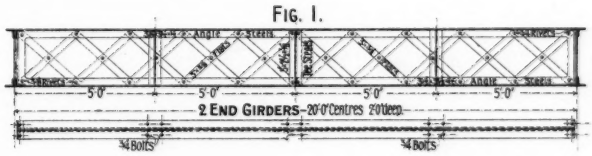
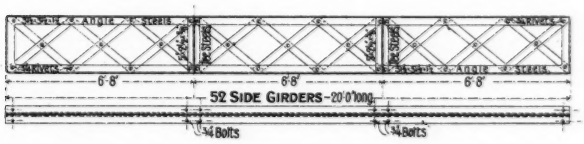
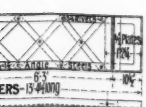


FIG. 1.



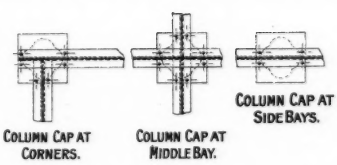




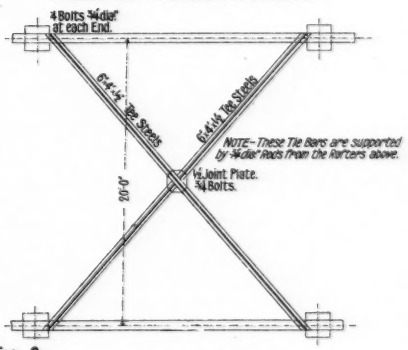


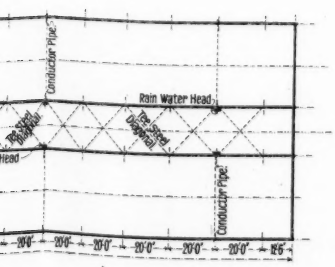
s for Shoes of Rafters.

-Holes in Bottom Flanges of Girders to suit those in Column Tops.



DIAGONAL TIES TO COLUMNS & GIRDERS.


4 Bolts ¾dia" at each End.
6"x¾" Tie Steels
NOTE-These Tie Bars are supported by ¾dia" Rods from the Rafters above.
½ Joint Plate.
¾ Bolts.
20'0"



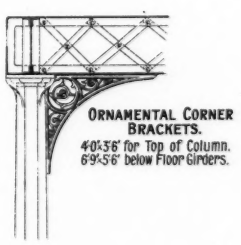


FIG. 2.

WALTER RALPH HERRING,

M.INST.C.E., *ENGINEER.*

THE GRANTON WORKS OF THE EDINBURGH AND LEITH GAS COMMISSIONERS.

DESCRIPTION PREPARED

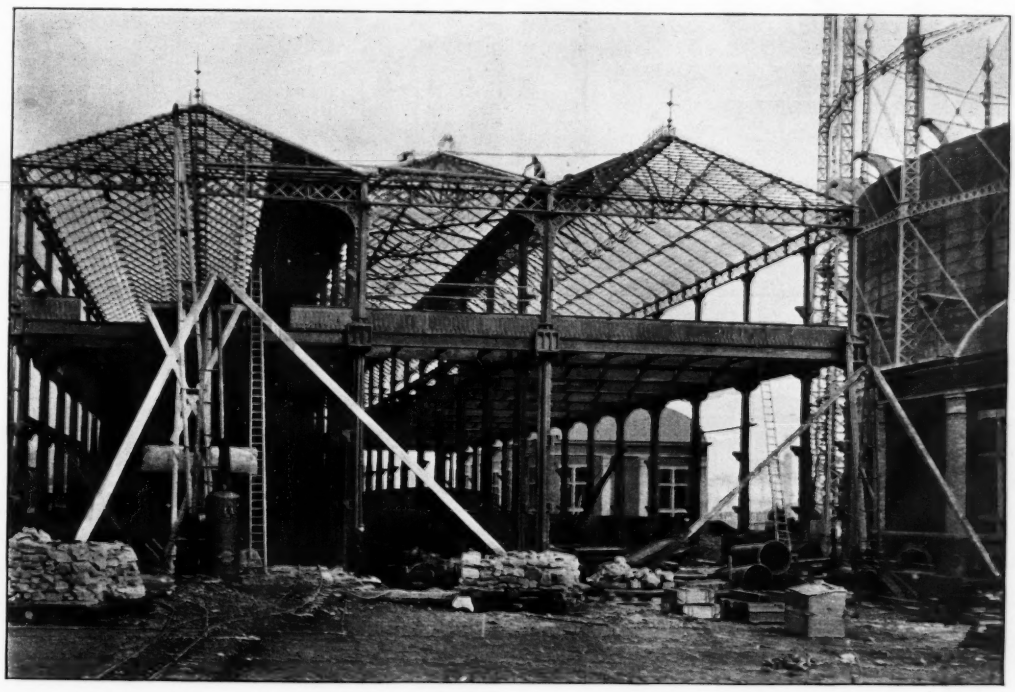
BY

WALTER RALPH HERRING, M.INST.C.E., *Engineer.* *

ARTICLE XXII.—Accompanied by Plate No. 23, illustrating the General Arrangement of the Purifying Plant House and the Details of the Roof Trusses and Girders.

The purifier-house is an open structure. In reality, it consists of an overhead concrete floor supported upon steel girders resting upon cast-iron columns; the overhead floor having a steel trussed and slated roof. This open type of structure was determined upon as a result of experience and considerable observation with regard to the excessive corrosion of iron and steel when placed within structures even more or less efficiently ventilated, but wherein the temperature is not uniformly maintained by artificial means. Without artificial heating or a thorough exposure to atmospheric conditions, cold surfaces in internal structures have a great tendency to condense and make visible the humidity of the air. Iron and steel, in particular, will often be found to be bedewed with moisture when the external air is apparently dry, and the atmospheric conditions fine and bright. This is accounted for by the difference in the temperature of iron and steel and the atmosphere. The latter changing as rapidly as it does in this country, it is almost impossible to expect substances such as stone and steel to acquire the atmospheric temperature within a reasonable period of time.

The result of this is that the surfaces of such material in enclosed structures are always more or less damp; the difference between night and day temperatures alone being sufficient to bring this about daily. As a result, it is found that girders and roofwork within an ill-ventilated building are always in a more or less damp condition—bedewed with moisture and often covered with blisters full of moisture; whereas similar structures exposed to the fullest atmospheric conditions do not display this characteristic. The inference is that the free circulation of air and wind around them keeps them more in tone with the atmospheric temperature and conditions, as well as drying up the moisture of condensation; whereas the steelwork contained within buildings



PHOTOGRAPH No. 114.—The purifier-house in process of erection.

is more or less protected from the rapid changes, and is consequently (as it were) always out of tone with the prevailing conditions. The best proof of this can be easily ascertained by an examination of, and a few hours reflection upon, the relative effects of corrosion upon steel or iron structures exposed to the full effects of atmospheric conditions, and steel and ironwork partially enclosed within ill-ventilated buildings. The external structure has all the advantages of drying air freely circulating within every crevice of its structure; whereas the circulation of air within a large masonry structure, whatever steps may be taken to admit of air and light, is more or less impeded and dormant. The rapidity with which the steelwork of purifier covers corrodes in brick or masonry purifying-houses, as compared with (say) gasholders, must have been remarked by many.

There is another advantage with regard to the open structure for a purifier-house, and that is, when opening a box, or in the event of the water-lutes blowing owing to excessive back-pressure, the gas escapes freely and harmlessly; whereas if only partially confined it might result in disaster. From my own experience, as well as from considerable observations elsewhere, I am quite satisfied that the ironwork of purifiers exposed in the open yard is much more durable than when it is contained within a masonry building of any description.

The necessity for the overhead floor in connection with purifiers is not exactly dominant. It, however, possesses considerable advantages. In the first place, it protects the men from atmospheric conditions while they are engaged in the operation of charging and discharging the purifiers, even when the roof is merely supported upon columns. It also enables a batch of material to be prepared and got into position immediately over the purifier to be charged, by which means a very large quantity of material can be manipulated in the course of a few hours—time being a very important object in this operation at certain seasons of the year. Without any mechanical aids whatever, with the exception of having the material handy on the floor above, we have been able to fill a box 45 feet long by 30 feet broad with slaked lime in a period of two hours, by discharging the material from the floor through canvas shoots leading into the boxes beneath, where it is distributed by a few hands—twenty men being all that are required for the operation. The overhead floor also affords economy in ground space; but where land is cheap, the space would be acquired at a greater cost than the value of land saved.

With lime purification, the floor area above the purifiers is sufficient for the entire operations in connection with the process; but where oxide of iron as well as lime is used, and the partially spent oxide has to lie out for revivification, the floor-area above the purifiers is insufficient in itself. All things considered, however, I am strongly of opinion that the overhead floor is of very considerable economy; and whether the structure is made

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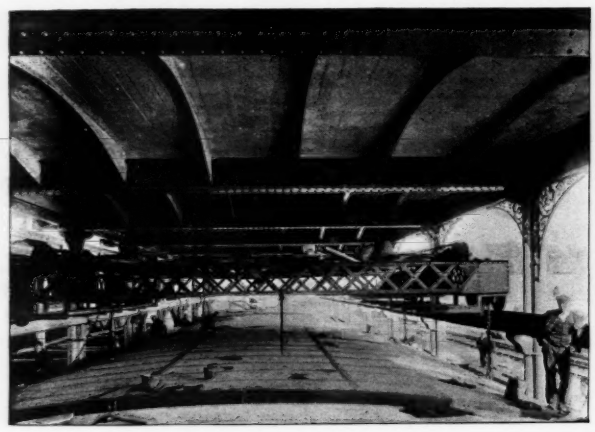
reasonably ornamental or not, is purely a matter for local consideration and circumstances. In our own case, by the addition of a few brackets, and the exercise of some care in designing the structure, a fairly presentable appearance has been given to this portion of the work.

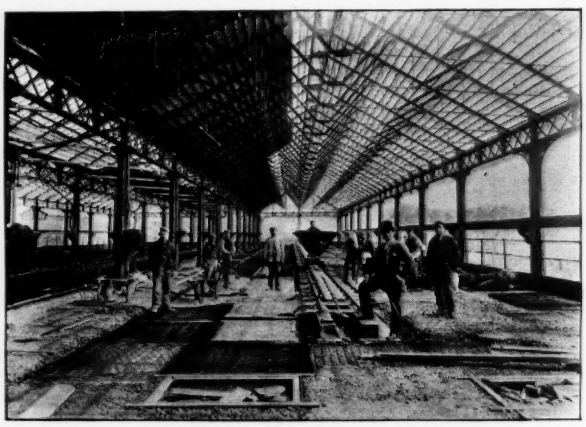
The purifiers, as before stated, consist of two complete sets of six boxes—each six being in one continuous line, 272 feet long by 32 feet broad over all, with an intervening space of 23 feet which forms the pipe-trench for the connections in double series communicating with the two systems of boxes. The method of raising the purifier-covers determines to a certain extent the type of structure to be erected. Longitudinally on each side of each set of purifiers, a line of columns is erected at 35 feet centres transversely and 20 feet centres longitudinally, excepting at either end of the building, where the end columns are 12 ft. 6 in. centre to centre (see Plate No. 23). These columns rest upon the foundations already referred to in a former article, when dealing with the question of the foundations for the purifiers.

The general character of the structure will be more readily appreciated by reference to Photograph No. 114. The columns are provided with seatings to which are attached brackets for supporting the joists carrying the rails upon which the mechanism for discharging the purifiers, and also for raising and lowering the purifier-covers, is placed. This method of construction leaves a central gangway between each line of purifiers 20 feet wide, within which the valves and connections are placed for serving the boxes. It also serves other purposes which will be hereafter referred to.

The floor above the purifiers is laid in concrete upon expanded metal. It is 4 inches thick, and is designed to carry a safe load of 3 cwt. per superficial foot of area, or the storage of slacked lime to a depth of 6 feet thereon. This load, together with the weight of the girders and the material forming the floor, put a very considerable weight upon the columns supporting it. For the sake of appearances, it was determined to employ cast-iron columns; but in calculating out the strains and the proportions of a column to carry such a load, the column appeared to be somewhat inelegant. After considerable scheming, therefore, the existing type of column—of quatrefoil section—was determined upon; and this has a very elegant appearance and enables the disposition of the necessary metal to carry the weight to be scientifically disposed of. The lower column weighs 3 tons 18 cwt.

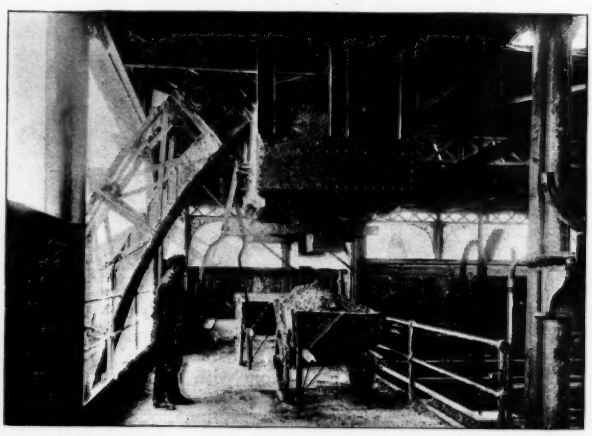


PHOTOGRAPH No. 115.—The purifier-house, with underside of expanded-metal concrete-floor on channel-ribbed arches.



PHOTOGRAPH No. 117.—The purifier-house illustrating the method of laying the expanded-metal concrete-floor.

PHOTOGRAPH No. 116.—The purifier-house. The expanded-metal concrete-floor, with centring laid ready for expanded-metal concrete.



PHOTOGRAPH No. 120.—The elevator from the lime-yard to the receiving tank, with the hand carts beneath the spouts.

and has a sectional area of 92 square inches at the lower part of the stem, and of 72 square inches beneath the capital. The main transverse girders resting on the capitals of the columns for their full breadth, necessitated—in order that the upper extension should have an equally solid bearing upon the lower part—a special form of stool to be constructed, which will be hereafter referred to.

The upper column, which has only the weight of the roof to carry, weighs 1 ton 5 cwt., having a sectional area at the base of 53½ square inches and 41¾ square inches at the top beneath the capital.

Several schemes were laid down on paper before the present floor was ultimately determined, in order to ascertain by which method the desired strength could be acquired with a minimum expenditure of material and money. The position of the columns longitudinally and transversely practically divided the structure into a number of bays, 35 feet by 20 feet in the span.

The first scheme was to span from column to column transversely across the breadth of the boxes with a main girder, and then to span the intervening breadth of 20 feet by means of joists resting upon or within the flanges of the main girders, and the construction of a concrete floor thereon.

The second scheme was to divide the 20 feet bay into two 10-feet bays, by introducing a main supplementary transverse girder across the breadth of the boxes, the ends of which would obtain support from a longitudinal girder resting upon the columns on the two outside faces, and then the construction of a concrete floor upon the 10-feet bays.

The third scheme, and the one actually in existence, consists of the construction of an expanded metal concrete floor supported upon channel ribbed arches resting upon two main transverse girders and spanning the 20-feet bay. This was found to be the cheapest for the complete construction, and considerably less than either of the former schemes as far as the expenditure of metal—and, consequently, money—was concerned.

Spanning transversely over the breadth of the purifiers, and

PHOTOGRAPH No. 118.—The mechanical appliances in the purifier-house. The dredger elevator discharging apparatus for the purifiers.

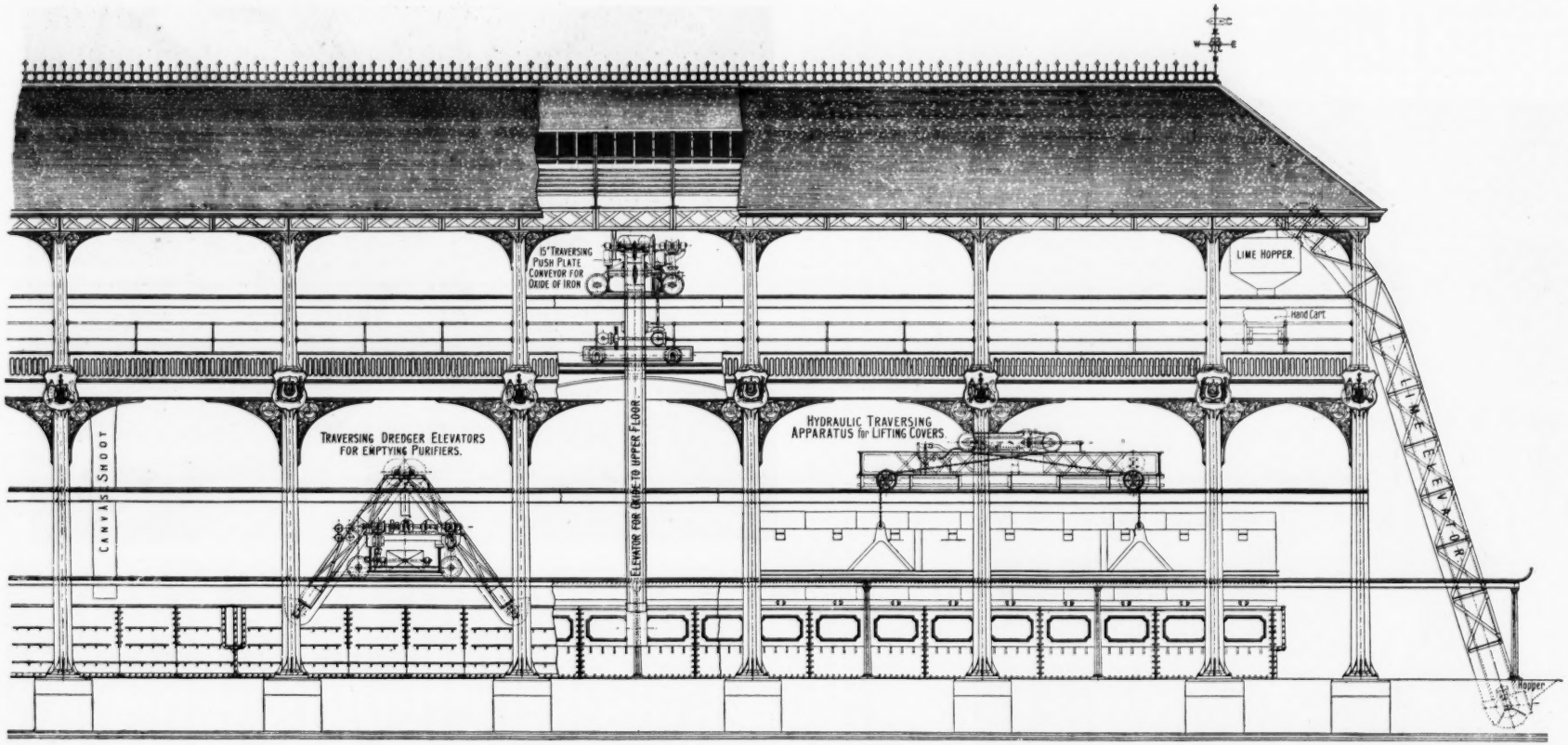
resting upon the upper flanges of the lower columns, a box-plated girder rests, appearing flush on the outside of the structure and projecting inwards centrally over the column a distance of 3 ft. 10 in. These main transverse girders consist of two 20 inch by 7½ inch by 89 lbs. H steels with three 18 inch by ⅝ inch flange plates riveted to the top and bottom flanges of the H steels; the box-girder thus measuring 1 ft. 11¾ in. deep by 18 inches broad, and weighing 414 lbs. per lineal foot.

Longitudinally with the columns, and secured to the webs of the main transverse girders throughout the exterior face of the structure, a simple 18 inch by 7 inch joist is secured, excepting at either end, where an 18 inch by 12 inch box-girder is provided, consisting of two 16 inch by 5 inch by 52 lbs. H steels with two flange plates 12 inch by ½ inch riveted to the top and bottom flanges, forming a box-girder 18 inches by 12 inches, and weighing 182 lbs. per lineal foot. The columns longitudinally in the inner gangway are tied similarly but by means of a simple 12 inch by 6 inch joist, also cleated to the webs of the main transverse girders and resting upon the flanges of a column in the same way as the outside line of joists. Where they come in contact with the columns, the rivet heads are countersunk, and a sheet of 7 lb. lead inserted between the cast-iron column and the steel joist both of the capital of the lower and the base of the upper column. As before stated, on the outside face of the building, the main girder is flush with the flanges of the columns. On either side of the main girder, and in order to form a continuous and solid base for the upper half column, a cast-iron saddle-piece is provided (as shown on p. 656), which projects exactly level with the upper flange of the main transverse girder, and is made in such a manner as to permit of the longitudinal tie-joists passing through the centre so as to form a perfectly square and true base for the upper half columns to start from—transmitting the weight directly to the main columns beneath. Upon these longitudinal tie-joists, a cast-iron entablature plate is fixed (as shown) upon the upper moulding of which hand-rail standards and hand-rails are secured, the upper surface of the floor being about half-way up the entablature plate on the inner side.

The junction between the upper and lower column, the end of the main transverse girder, and the shoes is, upon the outer faces of the building, covered by means of a number of shield plates with devices representing the Edinburgh City Arms and the Leith Arms.

The floor is constructed upon the channel-ribbed principle, as seen in Photograph No. 115 and in detail on p. 656. Longitudinally between each of the main girders, a 6 inch by 2 inch by 12 lbs. steel-channel curved rib is inserted, resting upon the bottom flange of the compound girder, and having a total rise of 1 ft. 11 in. from the springing-line to the crown. These are spaced 5 feet apart (centre to centre) transversely across the width of the floor; the outside longitudinal tie-joist taking the place of one of these channel ribs, as will be seen by reference to Photograph No. 115, and the inside tie-joist taking the place of another, although the floor is made to project into the inner gangway a distance of 3 ft. 10 in. The end is supported by means of a channel rib, although it also receives some measure of support

PHOTOGRAPH No. 119.—The mechanical appliances in the purifier-house. The traversing elevators in the central gangway receiving material from the mechanical dredger and delivering it to the upper floor.


15" Traversing Push Plate Conveyor for Oxide of Iron
Lime Hopper
Hand Cart
Lime Elevator
Traversing Dredger Elevators for Emptying Purifiers.
Canvas Shoot
Elevator for Oxide to Upper Floor
Hydraulic Traversing Apparatus for Lifting Covers.
Hopper

The Purifying Plant House.

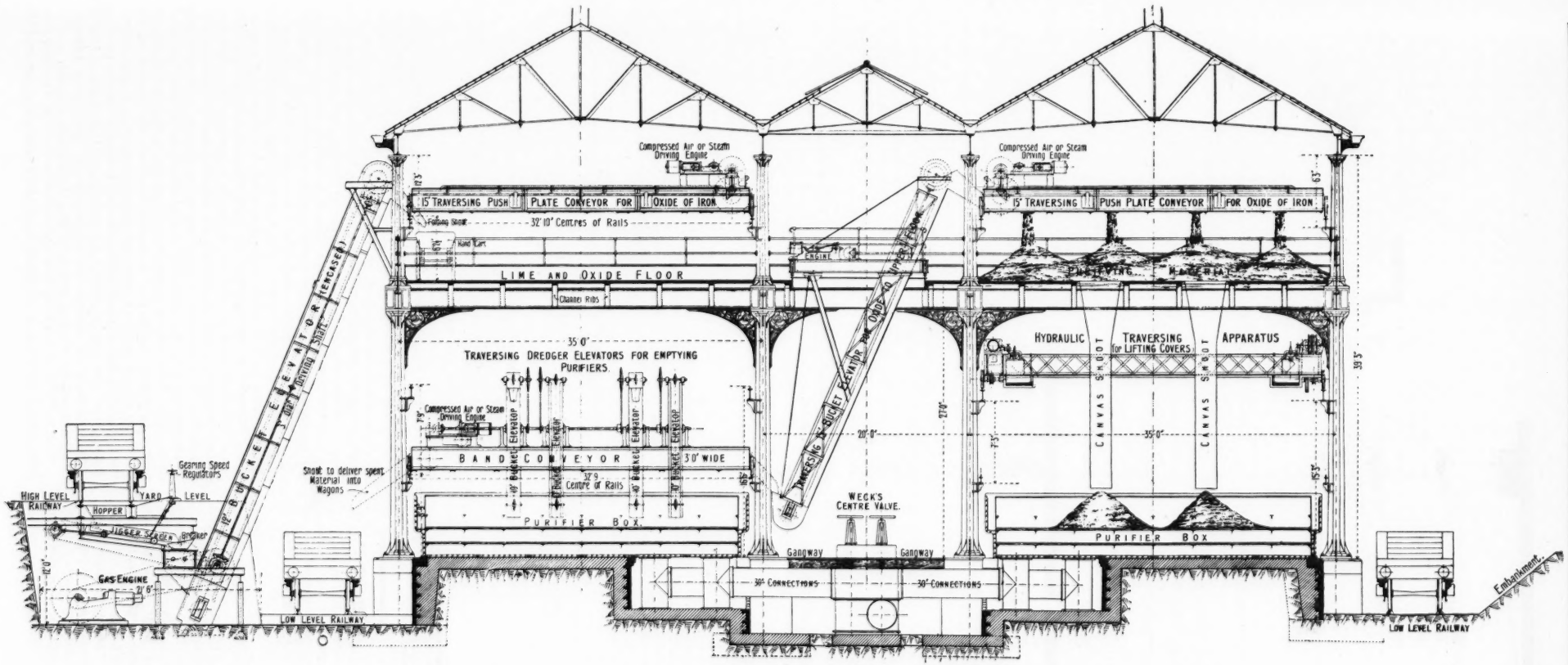
from the longitudinal joist supporting the rail for carrying the central traversing elevators. These channel ribs have their flanges looking upwards, and are afterwards filled in with concrete to the level of the underside of the floor.

The method of constructing this floor is pretty clearly indicated on Photographs Nos. 116 and 117. The former is a view from the upper side with the boarding placed in position, and upon which the expanded metal is laid, as seen in the background. The cavities immediately over the channel ribs are also easily discernible from this photograph. In the first place, concrete was delivered from the mixer by means of the narrow-gauge railway shown; the bodies of the waggons bringing the concrete from the concrete-mixing machine being lifted from their trolleys on the ground-line by means of a steam-crane at the end of the building, raised to the upper floor, and lowered upon another trolley running upon the narrow-gauge railway along the centre of the floor.

In the first place, the cavities over the channel ribs were filled in to a level with the centre boarding. Thereafter, the expanded metal was laid. This metal was similar to that already described for the retort-bench foundations; the sheets being No. 10a pattern, having meshes 3 inches wide and 8 inches long, the substance of the strands gauging $\frac{3}{8}$-inch by $\frac{3}{16}$-inch. The frames (which are shown in detail on p. 656), in the view of the general arrangement of the revivifying floor for forming the openings, were thereafter placed in position. Four of these were put over each purifier; the ends being secured to the channel-ribs and the sides buried in the concrete of the floor. Thereafter the laying of the floor was proceeded with. The expanded metal in the first instance lying close upon the centre boarding is slightly raised, when the concrete has been deposited thereon, in order that the fine stuff can be made to work through the meshes and form a reasonably even surface beneath—completely embedding the mesh.

The composition of the concrete used for this purpose was three parts of stone broken to pass through $1\frac{1}{2}$-inch mesh, one part clean sharp sand, and one part portland cement. The substance of the floor was 4 inches thick, as will be seen on reference to Photograph No. 117. The final surface was composed of equal parts of fine granite peas and portland cement, mixed by hand, and run and laid immediately after the levelling of the coarse material. Photograph No. 115 shows what an excellent job was made of this floor. The expanded metal lies only just buried beneath the surface, which is the underside of the floor—in fact, we only spent £19 16s. 9d. in finishing off the underside of the floor (an area of 2469 square yards) in order to give it the appearance which the photograph shows it to have. It is pleasant to be able to remark that this has proved in actual work a highly satisfactory structure.

The distance from the bottom of the purifier-tanks to the surface of the concrete floor is 27 feet. The upper line of columns

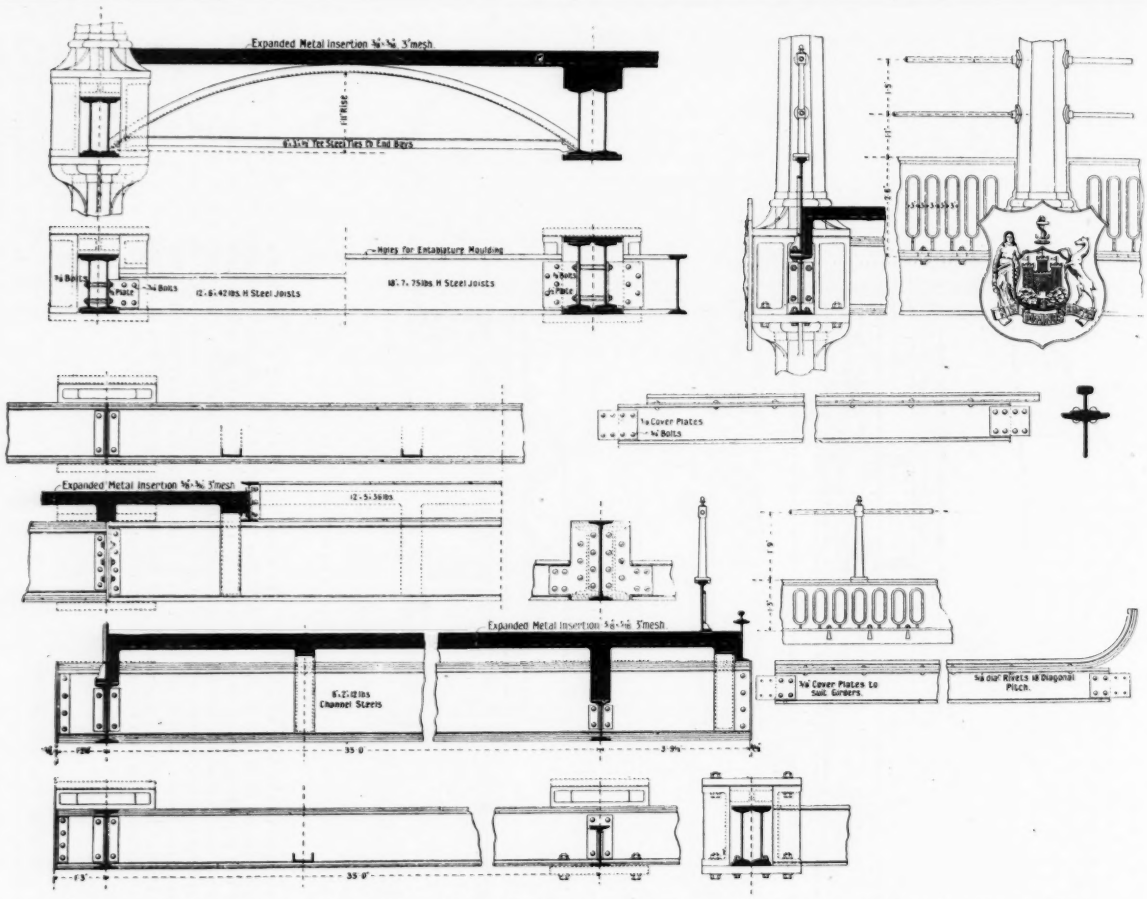


Mechanical Appliances in Connection with the Purifying Plant and the Manipulation of the Purifying Materials.

measures (over all) 13 feet, on the top of which are latticed girders, forming a complete frame round the exterior of the building and longitudinally along the central gangway. These girders are built up of $3\frac{1}{2}$ inch by $3\frac{1}{2}$ inch by $\frac{1}{2}$ inch angle-steels, with 3 inch by $\frac{3}{8}$ inch flat diagonal bracing, and 5 inch by $2\frac{1}{2}$ inch by $\frac{3}{8}$ inch T steel struts. The girders are bolted together, end to end, longitudinally; the four 35 feet span end-girders being joggled into the ends of the longitudinal ones. Upon the upper side of the girders, the shoes of the roof-rafters rest and are bolted thereto; the T steel struts in the latticed girder being placed immediately beneath the position in which each roof-rafter shoe is resting, and the end struts are similarly placed to catch the hip-ends and half-rafters. The general arrangement of the roof, together with the diagonal wind-ties, is shown upon Plate No. 23, fig. 1. Transversely, it consists of three spans, two of 35 feet pitch and one of 20 feet pitch; the smaller span covering the central gangway, and being provided with a large area of skylight which not only affords ample light on the purifying-house floor, but also, through the central gap in the floor, to the pipe-trench and the gangway beneath. The ridges of the two main span roofs are left open for a breadth of 1 ft. 6 in.; a cast-iron cresting-moulding being employed to finish off this portion of the work. This gap not only assists in the ventilation of the spaces beneath the slating, but is of supreme importance in the construction of an open shed subjected to high winds, in order to prevent damage to the roof and the possible lifting effect in a gale of wind beneath the slates.

Longitudinally between the central gangway, the structure is securely braced by means of 6 inch by 4 inch by $\frac{1}{2}$ inch T steel diagonal-bracing secured to the heads of the columns placed horizontally and at an angle of about 45°, as illustrated on Plate No. 23 fig. 2.

The method of charging the purifiers has already been incidentally referred to. The material upon the upper floor is shovelled and, by means of canvas shoots, conducted to the purifier beneath. Four shoots, with corresponding apertures in the floor, are provided over each box. By means of light rope-tackle attached to the lower mouth of the shoot and secured to ring bolts in the purifier-tanks, the distribution of the material upon the surface is easily accomplished with a minimum of labour, expense, and time. In order to have the material upon the upper floor, two elevators have been provided, one of which is in connection with a breaker for handling the lime. The lime is received in railway waggons, and discharged into a hopper between the rails where, by means of a jigging screen, the small lime falls through direct to the elevator, and the larger pieces pass through a breaker to the elevator boot. From this point it is elevated and thereafter discharged into one cubic



DETAILS OF COLUMNS AND STRUCTURAL STEEL-WORK AND THE EXPANDED-METAL CONCRETE-FLOORS IN THE PURIFYING PLANT HOUSE.

yard hand waggons on the upper floor; and thence it is wheeled and deposited in position ready for slaking in the ordinary course. The elevator at the end of the purifier-house is on a much larger scale than the lime elevator—above described—which is capable of elevating 16 tons per hour, whereas the elevator at the end has 30 inch buckets and is capable of elevating 29 tons per hour. This communicates with an open piece of yard between the two lines of railways running on either side of the purifiers—an area of about 2373 superficial yards—and is used as the yard for revivifying the oxide of iron, 33 per cent. of which is used in connection with the purification.

Plate No. 23 shows in a general way the position of the low-level railways on either side of each set of purifiers. They are arranged so as to enable the contents of the boxes to be freely discharged by means of shoots into the waggons beneath, either by hand or by other means. The "other means" will perhaps be better understood on a reference to Photograph No. 118, which (simply defined) consists of a belt conveyor running transversely within the two main girders, and which in turn is fed by means of four swivel elevators. The whole of this apparatus is both driven and (if necessary) propelled by means of engines actuated by compressed air—see engraving on p. 656. The belt is reversible, and can be made to run in either direction—that is to say, either outwardly for discharging the material into shoots for filling the railway waggons, or the reverse, where it would discharge the material into the boot of an elevator to be hereafter described. The whole apparatus is made to traverse upon the rails and joists shown, and is made to clear the covers of the boxes by arranging the four small elevators to swivel and assume the horizontal line—being approximately balanced in the position shown, and the angle altered, by tightening the chain. This is also necessary to enable the apparatus to pass clear beneath the traverser for raising and lowering the purifier covers.

The method of working this apparatus is to bring the elevators into such a position as to clear both the purifier covers and the

lifting apparatus. By means of flexible connections, a double-cylinder encased engine is set to work, and the whole apparatus traversed like a travelling crane, until it is in position over the boxes to be discharged. The elevators are then lowered sufficiently to enable the boots to clear the top layer of material in the boxes. Two men are then set to work to dig the material and load it into the boot of the small elevator—eight men being therefore engaged in addition to the one on the engine. At first, it was thought feasible to employ these elevators as dredgers; but the additional mechanism that would need to be introduced to give them the parallel traversing motion to be a success as dredgers (in addition to which the greatly increased strength required to remove the lime, which is sometimes pretty hard in purifiers) induced me to be content with the arrangements as they now exist. In the case of spent lime, the material is immediately discharged into the railway waggons on the outside of the range of purifiers; but with the oxide purification, the material is discharged into the boot of one of the traversing elevators shown on Photograph No. 119. This elevator is suspended upon a traversing frame and made to run upon rails resting upon the girders of the upper floor: the engine being of the same type as that on the discharging machine, and is entirely encased from the effect of dust and grit. The material received by this elevator from the discharging machine is elevated and can be discharged in a pile upon the upper floor, or is preferably discharged into a traversing conveyor (p. 654) for distributing the material upon the upper floor. By these means, the economy in the manipulation of the material in the purifying-house will be very considerably reduced.

THE PUBLIC CONTROL OF GAS UNDERTAKINGS.

In discussing recently the general question of the regulation of what are distinguished in America as "public franchises," to the best advantage of all concerned, we were able to bring into prominence the weighty dictum of Mr. Alton D. Adams, that the primary object of all such statutory obligations as can be properly laid upon a gas company is that of having a capital adequately represented by assets. In view of the cardinal importance of this truth, and the comparative freshness of its declaration as a distinct principle, a further investigation of its bearings upon gas legislation will not be a work of supererogation. The haziest ideas have prevailed in past times, and are not even yet extinct everywhere, as to the reasons why a British gas company should have an Act of Parliament at all, and what is the intention of the Legislature in granting this privilege, such as it is, without payment. It is easier to perceive the advantages to a gas company of having an Act of Parliament, than to understand where the benefit to the public comes in under such an arrangement between Parliament and a gas company. Yet there are more gas undertakings doing business in the United Kingdom without the protection of a Private Act of Parliament than would be suspected by those who have never given attention to the matter. These non-statutory undertakings (which are often the private property of individuals and business firms) exist on sufferance of the local highway authority. They cannot touch the public roads for main-laying purposes without first obtaining the consent of the authority, which operates by sparing them from proceedings for causing a nuisance in this way. No such complaint would lie against a statutory company, who, being authorized to carry on their business, cannot be hindered from doing it in every necessary and proper way.

The law as laid down by the United States Supreme Court, in the case of *New Orleans Gas Company v. Louisiana Light Company*, appears to be different from this. As quoted by Mr. Adams in his paper for the National Convention on Municipal Ownership, noticed in the "Journal" for the 26th ult. (p. 507), the Court declared that the manufacture of gas and its distribution by means of pipes "laid under legislative authority," is not an ordinary business in which everyone may engage, but "is a franchise belonging to the Government, to be granted for the accomplishment of public objects to whomsoever and upon what terms it pleases." This reads as if the very application for statutory authority to lay pipes must be preceded by the grant of a franchise. It is not so in England. Anybody can undertake to sell gas made on his private premises, without asking permission, unless he desires to lay a pipe in a public road. Permission to do this is not in any sense a franchise. It does not confer any value on the property of the undertaker which it did not previously possess. Nobody would advance a shilling upon it, as collateral security. Indeed, the Courts have ruled that the local authority must not act unreasonably or oppressively in such a matter. The property of the public in a thoroughfare is limited to the working surface, and, so long as this is not interfered with, the highway authority cannot act against those who run wires overhead or lay pipes underneath at their own risk. Roads can be crossed or traversed by sudden operations which hurt nobody. Where there is no franchise, there is no corresponding obligation on the part of the licensee to carry on his business otherwise than at his own will and pleasure. He can pick and choose his customers and charge any prices he likes to ask, precisely as if he were a street huckster.

Conversely, it has been contended by such good authorities as Mr. Thomas Newbigging, that the lack of a Private Act of Parliament ought not to be reckoned as a depreciatory factor in calculating the price to be paid by a local authority for the gas undertaking serving its district. This is certainly just. A local authority is bound to respect the property in a gas undertaking in its midst. It could not obtain sanction to expend money borrowed on the security of the rates for a competing gas undertaking. Therefore a gas undertaking which is coveted by a local authority is worth neither more nor less to the latter for having statutory powers. As regards the public, it is different. Although an Act of Parliament is not in itself worth a very great deal to a gas company—it will not make an unprosperous concern a paying one, or anything like that—it constitutes a security under cover of which its finances may be regulated and its business developed to the best advantage. Of course, there are specific things for which an Act of Parliament is necessary and indispensable—as for obtaining land compulsorily, as well as for the privilege of main-laying already distinguished. But these rights and facilities are not necessarily worth hard cash. They are perhaps as essential to the undertaking as the backbone to an animal; but this is not to say that they possess any separate value possible to be realized. This is the consequence of Mr. Newbigging's position. For if a gas undertaking is not to be depreciated for lack of statutory powers, it certainly cannot be appreciated in value for possessing them.

It is one of the vague ideas which have been mentioned as prevailing in the past, that an Act of Parliament constitutes an enormous privilege and protection for a gas company, behind which it can practically do anything it likes without fear of reprisals. This is a fatal error. An Act of Parliament does not even preclude competition; and it is always open to be varied or repealed by the same power which bestowed it. It is defensible only on its merits. If it can be proved to the satisfaction of Parliament that a gas company's Act has operated detrimentally to the public, it will be amended. Mr. Adams makes the point that "the supply of gas, being a public calling, is subject to the common-law rule that rates must be reasonable." This is intended to be provided for by the well-known procedure prescribed by the Gas-Works Clauses Act. 1847, which still remains valid. Although the question is now only of academic interest, it is open to be argued that the Act of 1847 did not, except by implication, forbid the issue of bonus capital. "Michael and Will" knows nothing about such issues. They are commonplaces of company administration in the United States. The most notorious example is that of the Boston Gas Companies. In 1897 the capital stocks of four Boston Companies, with an aggregate par value of $3\frac{1}{2}$ million dollars, "also a certain gas and coke plant of unknown worth," were conveyed to a Board of Trustees. These Trustees proceeded to issue $17\frac{1}{2}$ million dollars of so-called stock, and another equal amount of bonds, using the aforesaid properties as security for these issues. Subsequently, interest on these bonds was defaulted, and the Trust was reorganized—first with 30 million and later with 50 million dollars capital stock. This is the amount on which the Boston gas consumers have to pay a dividend. Evidently it would not be of much use to impose a tax upon this valuable franchise. This is a case in which the worth of the undertakings has been destroyed from within, by those who should have protected it and made the most of it. It is difficult to conceive of regulations that might always be depended upon to prevent such malfeasance. The peculiar interest of the Boston example lies in the circumstance that the State of Massachusetts has now for many years had a Government Commission in existence with extensive powers, intended to prevent this kind of scandal.

Professor Parsons assured the National Convention that while control through Commissions works very well with the small gas companies that have not much capital, it does not answer with the big concerns. The State Railway Commission does not protect the people against the secret rebates, or even attempt to get at the facts, although allegations are made that certain traders are favoured with from 10 to 72 per cent. discounts on published rates. As regards gas, if there is a case of gas over-capitalization in the world, it is in Boston, where the figure amounts to more than $42 per 1000 cubic feet of output. In Chicago and New York, the capital paid on is only $9 or $10 per 1000 cubic feet. The British average is about 10s., or (say) $2\frac{1}{2}$. It is no wonder, therefore, that Mr. Adams is struck with the enormous importance of this factor in the finances of gas manufacture. The worst of it is that this weakness for over-capitalizing everything that will stand it, is declared to be part of the American business man's habit and training.

One of the most pointed of the contributions to the National Convention was by Mr. R. R. Bowker, formerly the working head of the Edison Electric Illuminating Company, of New York. He owned to being a convert from the belief in competition in lighting supply, and he is prepared to maintain that one executive, and a very small one at that, is best for the purpose. He is also dead-against municipal trading, not on any fancy ground of mere principle, but simply for the reason that a municipal body cannot deal with the labour interest. He saw enough of this in England to confirm him in the judgment that business enterprise and city government ought to be kept distinct and separate. Mr. Bowker believes that even the Consolidated Gas Company of New York, which has been called the "octopus," on account of the all-embracing nature of its grasp, is to be preferred to a

number of independent gas companies and street railways. He declares strongly in favour of monopoly in such services, but admits the necessity of control in the public interest. This control should operate, first, in securing publicity of accounts, which is put as the prime necessary, and at the same time as a just acknowledgment of the public interest. Secondly, there should be every possible precaution against over-capitalization. Mr. Bowker confesses that this is a very difficult thing to reach; and he owns that it can be best reached indirectly. Thirdly, he fully accepts the principle of limitation of dividend, which was practised by the Edison Company for the reason that the best way to do business was to cheapen prices. Fourthly, Mr. Bowker proposes that all gas-mains, electric light wires, and street tramrails should be owned by the municipalities, although operated by the working companies. That is to say, every kind of street plant should, in Mr. Bowker's opinion, be definitely owned by the local anthority, for the reason that this would put the town in a position to make terms with the companies under leases sufficiently long to give the companies a chance to make a fair return, with provision for equitably transferring property rights in case of any change of lease. Finally, it is suggested that there ought to be a competent system of inspection of the operating companies, from one end to the other, in the interest of the public. The inspecting officials would be able and impartial experts, paid sufficiently to render them independent of outside influences, and competent to advise on any points in regard to which they might see that the public could be better served. It is something of the same idea that inspired the appointment of the first Metropolitan Gas Referees. Unfortunately, experience shows that these appointments are difficult to satisfactorily fill, especially for a long term of years. Still, there is unquestionably something in Mr. Bowker's suggestions.

ELECTRIC LIGHTING MEMORANDA.

Electricity Supply in London—A County Council Return—Object of the Return—Aggregate Loss of the Local Authorities.

In connection, probably, with one of their annual and regularly abortive parliamentary schemes, the Statistical Officer of the London County Council (Mr. E. Harper) has prepared an analysis of the accounts of the electricity supply undertakings established in the County of London by companies and local authorities, and it has just been published as one of the official papers of the Council, which are as useful in their way as Blue-books. It is entirely the fault of the Council itself if its publications are not regarded as quite on an equality with those of the Government; for the chief officers and those who are responsible for the preparation of these documents are remarkably good at the work. The weakness that destroys all respect for the official publications of the Council is their subordination to some ulterior object—or public suspicion of the fact, which amounts to the same thing. Consequently, when a fresh publication of this kind appears, the natural impulse of those who are interested in its subject—as, in the present case, the "Electrician"—is to wonder what it was done for. We find no particular indication of a purpose in the paper itself. The Council are not the Metropolitan Local Authority for the purposes of the Electric Lighting Acts, and have hitherto failed to acquire this statutory position. They are, however, the authority for testing and inspecting electric lines, works, and meters. In practice, nothing is attempted beyond the testing of meters.

At the present time there are fifteen Local Authorities and fifteen Companies possessing statutory powers for supplying electricity within the Metropolitan area, besides which the County Council themselves light the Victoria Embankment and Waterloo and Westminster Bridges. They are responsible, that is to say, for the deplorable treatment, as regards lighting, of some of the noblest public works in London. A scurrilous critic in the "Studio" once declared it to be his opinion that the real designer of the Waterloo Bridge electric lamp standards and lanterns must have been a housemaid in the employ of some big-wig of the Council; for the general shape of these specimens of applied art and craft is that of a bass-broom reared on end. But to return to the paper. It is recorded that, in addition to the statutory suppliers of electricity in London, there are two non-statutory undertakers of such supply—one for Smithfield and the other at Hampstead. The first salient fact to be noticed in respect to the London Electric Light Companies is that their areas are not identical with those of the Metropolitan Boroughs. Consequently, the accounts relating to the borough areas are not published separately; and this is regarded as a serious matter, in view of the possibility of the purchase of the undertakings by the Local Authorities in 1931.

One object of the return is to show the extent and the conditions under which competition in electricity supply is sanctioned in the Metropolitan area. It is explained that the policy of the Board of Trade has been not to allow Provisional Orders to be obtained by Companies for competing with Local Authorities previously authorized to supply. It would have been equally correct to state that the Board of Trade have not allowed Local Authorities to compete with Companies doing effective business. For a right understanding of the matter of which only one aspect is here shown—so like the London County Council!—reference should be made to a reply given by the President of the Board of Trade to a question addressed to him in the House of Commons by Dr. Macnamara on the 20th ult. Mr. Gerald Balfour said that the practice of the Department in granting competitive powers in the Metropolis has been confined to the more urban and populous parts, and that competitive Orders have been refused in Clerkenwell, St. Luke's, Hackney, Newington, and Wandsworth. Although the Board of Trade allowed the Local Authorities competing Orders in several areas, this was because the powers of the Company had not been effectively exercised. The parts of London where there is real competition between rival Companies are the City, Westminster, Chelsea, Finsbury, and a few odd corners interlapping areas.

The main object of the return is stated to be that of presenting the various statistics and the analysis of accounts in such a form that the undertakings of the Local Authorities and the Companies might be "readily" compared. Readily is the word. It certainly is not "accurately" in every case, if any regard is to be paid to the ascertainment of truth. The first table put forward by the ingenious statistician shows the undertakings in the order of the lowest price obtained for private supply. This gives the pride of place to the Local Authorities; nothing being stated to indicate that their prices are unremunerative. Most of these undertakings, moreover, are fine examples of the economic process known as "feeding a dog with his own tail." The proportion of public to private lighting done by these authorities runs up to 43 per cent. in the cases of Poplar and Islington. The St. James's and Pall Mall Company get off with 2 per cent. of street-lamps; and several other Companies light none at all. The accounts of five of the Local Authorities are hopelessly complicated by the inclusion of dust destruction among the electricity generation accounts. Different methods of accounting for this element are followed in these cases; that of Fulham being apparently the most straightforward. Here the charges on the destructor are included in the cost of generation; and an amount is credited from the cartage department for destroying the refuse. The result is a loss on the whole affair of £4479. They are all, however, in the same boat. Battersea is £3850 to the bad; Bermondsey, £1084; and Hackney, £2637. These are the youngest undertakings; but the oldest are even worse off. St. Pancras was the pioneer of these adventurers, starting in 1891. It still feeds itself with 24 per cent. of street lighting; done at the respectable price of 2½d. per unit, which is considerably more than any Company's price except the St. James's and Pall Mall, which is the same. It just contrives to increase its balance by £164, after making the enormous effort of writing off £1895 from capital expenditure, and placing £3000 to reserve. The year's provision for depreciation works out to 0·54 per cent. of the net capital expenditure. The solvent Companies, such as the St. James's and Westminster, put by something like 3 to 4 per cent. on the same account. Yet St. Pancras stands at a capital burden per kilowatt of plant installed of £95, while the St. James's Company are already down to £78.

This return does in truth lend itself to the drawing of instructive comparisons, only they must be drawn for oneself. An interesting contrast is that of the rates and taxes paid by the Local Authorities and Companies respectively. Municipal trading contributed to the rate and tax funds in this way a total sum of £11,000. Company trading paid £50,716. Not a single penny reached the ratepayers in any other way, while the total balances of the Local Authorities' undertakings showed a decrease of £7124 for the year. This is municipal trading in electricity supply, as exemplified in London. It is to be hoped that the ratepayers approve of the picture.

British Association of Water-Works Engineers.—The Annual Meeting of the British Association of Water-Works Engineers will be held at Bolton, under the presidency of the Corporation Water Engineer (Mr. R. H. Swindlehurst, M.Inst.C.E.), from July 21 to 24.

Electrolysis of Water-Meters.—In the course of a paper read by Mr. A. A. Knudson at the annual meeting of the American Electro-Chemical Society, the author, whose investigations into the subject of electrolysis have been noticed in the "Journal," stated that his attention had been called by the superintendent of water-works of a certain city to several water-meters which, it was said, had been ruined by electrolysis caused by railway currents. After making careful tests and not finding any signs of current, he had one of the meters taken apart for closer inspection, and found in the interior a brass valve arranged to move over iron slides—these being a part of the iron frame of the meter. Suspecting galvanic action, he turned on the water from a tap, and allowed the meter to work as in practice, when it was found that there was a difference of potential between the valve and the slides of 0·004 to 0·008 volt. This meter had been in use about twelve years. A water-meter or other like instrument constructed with dissimilar metals, such as brass valves running upon iron guides in brackish water with an average difference of potential of 0·006 volt, will, in twelve years, be ruined by electrolysis due to galvanic action, and register inaccurately in a much shorter period. Electrolytic damage, attributed to return tramway currents, may possibly often be traced to similar causes.

THE PRESENT AND FUTURE OF THE HASTINGS GAS-WORKS.

[Third Article.]

The Retort-House Equipment.

Mention has already been made of the fact that the relative claims of the two rival systems of carbonization—inclined retorts and horizontal ones, machine worked—were well weighed by the Engineer, who pronounced (at all events so far as the first house is concerned) in favour of the latter, though the building has been erected so as to be capable at any future time of accommodating the former, should further experience lead to any change in judgment. The contract for the settings has been let to the Winstanley Speciality Company of Birmingham, who are now engaged on the work. There are two benches—each of nine beds of eight 20 feet through retorts, 22 in. by 16 in., oval dees. The settings are on the regenerative principle as perfected by Mr. George Winstanley. They are found to be very suitable for the class of coal carbonized by the Company, and for the fuel they answer exceedingly well. For both benches of retorts, one central chimney is being erected; and provision is left at either end for additional or boiler chimneys should they ever be necessary or desirable. The ironwork bracing for all the benches (which is included in the contract for the settings) is, of course, arranged in such a way that none of the hydraulics or foul mains are connected to the brickwork. The vertical buckstays, too, are to be utilized to carry the cross girders of the stage-floor. These girders will be spaced about 11 feet centres; and between them will be expanded metal arches. [In the construction of the buildings fortified concrete work has, as will be shown in the course of this article, been brought into use very extensively.] These concrete arches will be about 8 inches thick, and paved with blue bricks. Openings will, of course, be left for the coke to shoot into trams below, or into a conveyor as the case may be. Provision is also made for stairways to the basement. The system of charging and drawing has not been absolutely determined; but compressed air machinery is contemplated, with continuous overhead hoppers, and the usual auxiliary plant.

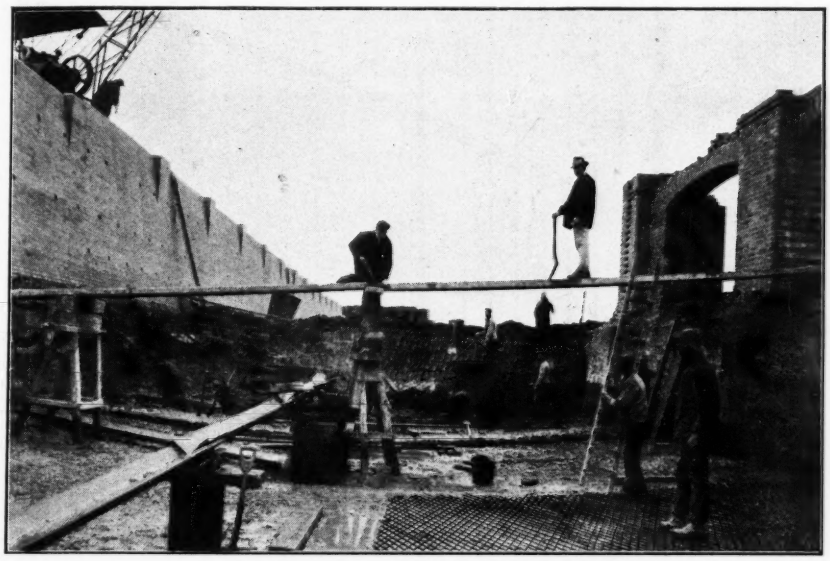


Fig. 10.—View Showing the use of Expanded Metal in the Invert for the Bottom of the Water-Tanks.

(The work is in progress at the end of No. 1 Section where the Settling Tanks will be under the Stokers' Lobby, &c. The Concrete in the main portion of the Invert is 9 inches thick; the Expanded Metal being laid as close to the lower surface of the Concrete as possible.)

The Stokers' Lobbies.

In connection with the retort-house, mention ought to be made of the stokers' lobbies. The plans indeed include very generous provision for the comfort of the men. The lobbies will be on the stage-floor line at the west end of the house. The stage-floor is to be continued on arches across the intervening space between the No. 1 and No. 2 retort-houses; and this floor will give access to the lobbies, which are to be built half-way into the coal-store. The lobbies will be very convenient for the men—being situated, in fact, only a few yards from their work, so that they will not, when in a heated condition, be in any way exposed to draughts or inclement weather. In conjunction with the lobbies will be the foreman's office, and the lavatories. In the previous article, reference was made to the large openings that have been left in this end of the house, and their special purpose of permitting ingress and egress of the stoking machinery. The gangway, or extension-floor, here described will be used for running the machines across from one house to the other.

The Coal-Stores and Water-Tanks.

The situation of the coal-stores between the retort-house and the railway siding retaining-wall has been explained. It is intended that the stores shall be continuous throughout the prospective Nos. 2 and 3 sections. No. 1 store is practically 300 feet long and 44 feet wide, and will probably accommodate, if filled up to the depth calculated upon, something like 4000 tons of coal. To our mind, one of the most interesting features in connection with these stores is the provision made below for storing water; and this was a most suitable place, inasmuch as it is the lowest point

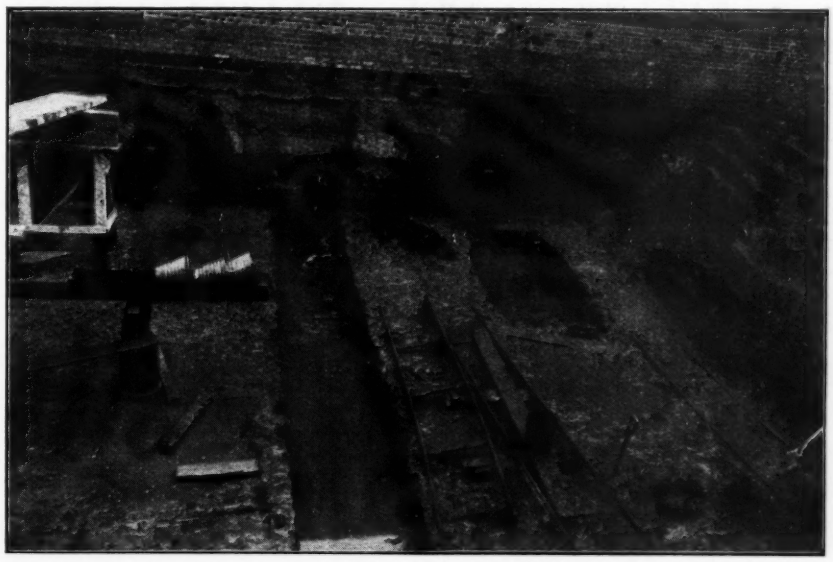
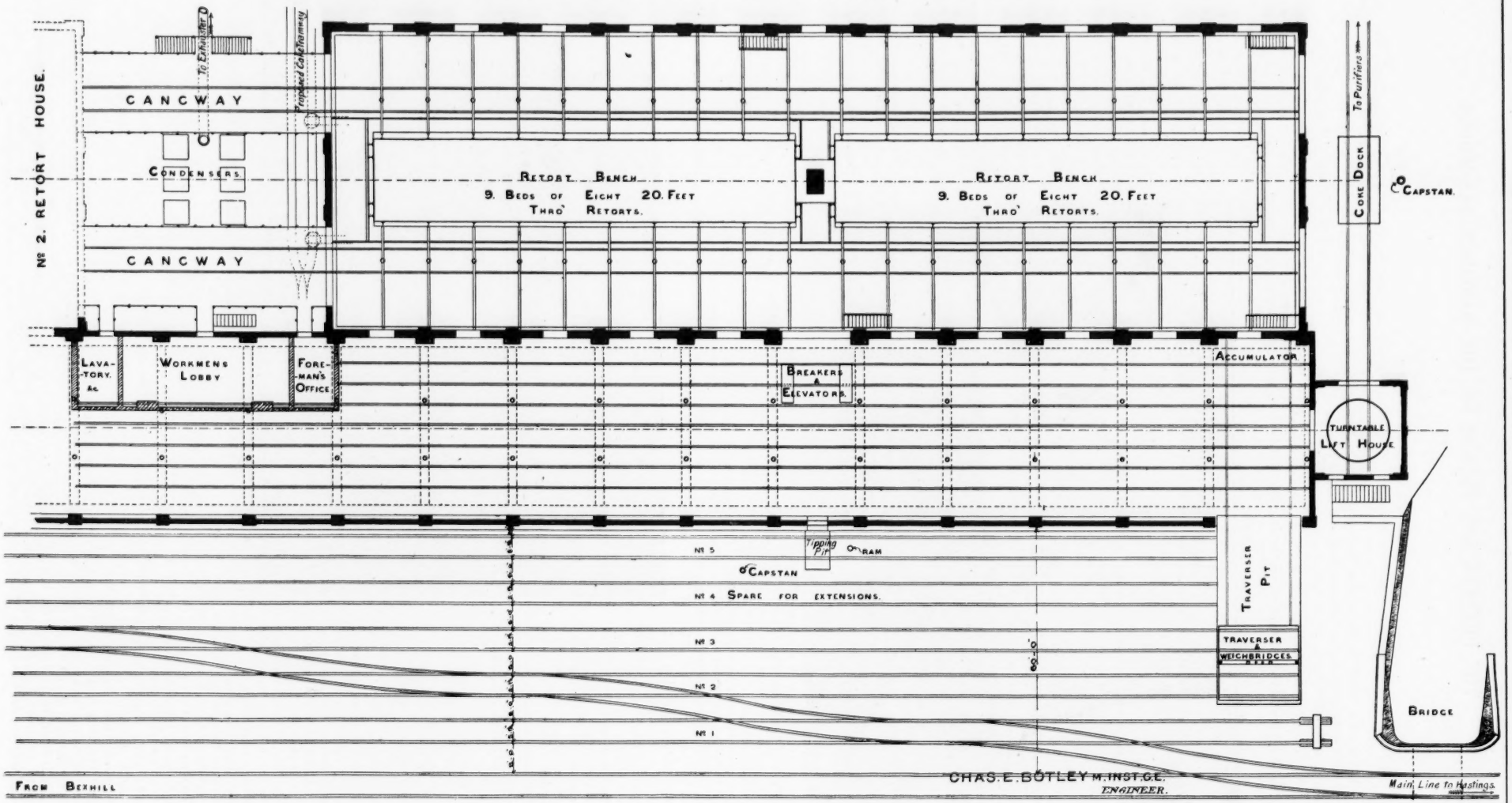


Fig. 11.—Footing Trench for one of the Cross Concrete Arches, as referred to in Fig. 13.

(Expanded Metal is laid in the bottom of the Concrete, which is 2 feet thick as compared with the 9 inches through the body of the work.)

THE NEW GLYNE WORKS OF THE HASTINGS AND ST. LEONARD'S GAS COMPANY.

No. 1. Carbonizing Section—Plan at the Stage-Floor Line.



on the site, so that all the water used for quenching, condensing, &c., will return by gravity. Even if the space had not been utilized for the tanks, it would have been necessary to fill it up. The water storage provided in this No. 1 section is about ¼ million gallons; and the advantage of this it is scarcely possible to estimate. It will mean in the long run very considerable saving to the Company, besides enabling them to use processes which would be otherwise restricted owing to the want of a full supply of water. After the water is used for quenching, condensing, and such-like purposes, it will return by gravity to a settling-tank, open to the air, and readily accessible for cleaning. From this tank, it will overflow into a second one, and then finally into the

general storage, from which it will in all likelihood be raised by air-ejectors (the air-compressing machinery which will be installed in connection with the retort-house machinery being available for the purpose) to overhead tanks incorporated in the design for the coal-store roofs.

Now as to the construction of the water-tanks and the coal-stores. The railway retaining-wall and the foundations of the retort-house on this side (which were expressly carried deep down for this purpose) assisted very materially in the building of the tanks. The bottom of the tanks, generally speaking, is on very bad ground; and consequently expanded metal (Nos. 8 and 9) was used in conjunction with the concrete. Besides the considerations of solidity and strength, the expanded metal confers the additional advantage of increasing the capacity of the tanks, by rendering unnecessary the additional thickness of concrete which would otherwise have been needed to make the floor a sound and water-tight piece of work. The general thickness of the concrete in the floor of the tanks (which is really an invert) is 9 inches; and the proportions are 6 to 1—portland cement being used as in the case of the retaining-wall. To ensure the tanks being sound, they are rendered with cement; and, though not quite finished yet, apparently they will prove most satisfactory. [It may be mentioned here that the accompanying section of the coal-stores p. 662 does not show the invert water-tanks completely. The section is taken through a portion of the coal-stores adjacent to the retort-house—not through the lobbies at the far end of the house.]

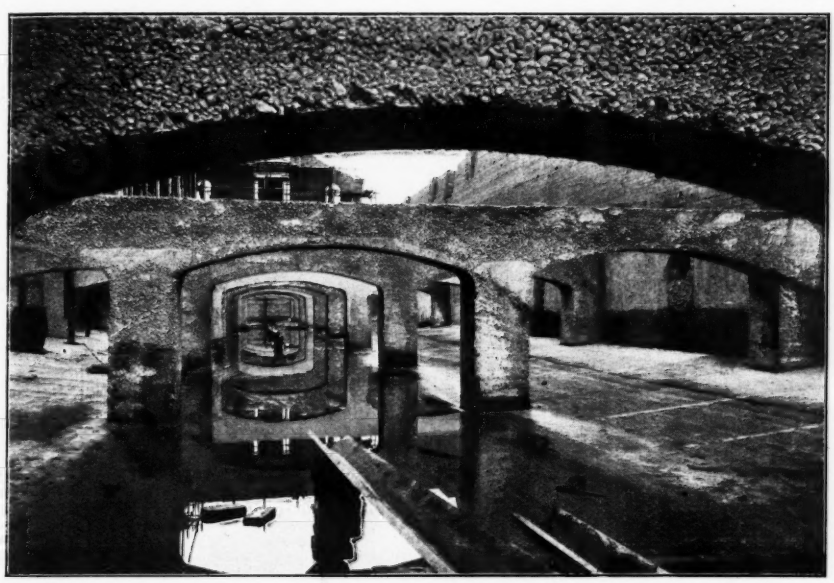


FIG. 12.—WATER-TANKS, LOOKING TOWARDS THE LIFT-HOUSE OR HASTINGS END.

(The Cross Concrete Arches and Struts are well shown. The Cross Arches not only serve to carry, with the assistance of the intermediate Piers, the heavy Floor for the Coal-Stores, but secure the Footing of the Retaining Wall. Where the Concrete Arches and Piers are—that is, where the weight from the Coal-Stores is concentrated—an extra Footing of Concrete 1 ft. 3 in. deep by 3 ft. 9 in. or 3 feet wide, with Expanded Metal in the bottom, is used. See Fig. 11.)

The floor of the coal-store above, which will be very heavily loaded—in fact, it may have to carry ½ ton per square foot—will be supported by girders on cross concrete arches (No. 9—$\frac{3}{16}$ in. by $\frac{1}{8}$ in.—3-inch mesh expanded metal being used), at 21 feet centres, and intermediate piers of blue bricks. [Parenthetically, it may be mentioned that the overflow-line of the water-tanks is about 6 inches above the top of the concrete arches.] As the weight from the coal-stores will be concentrated at the arches and piers, footings of 3 ft. 9 in. and 3 ft. wide respectively, with expanded metal in the bottom side, have been provided. Nos. 10 and 9 expanded metal has been used for this purpose according to the nature of the ground. The thickness of the footings is 2 feet, or a little more in case of very bad places. The floor of the coal-store will be made like the retort-house stage-floor, with longitudinal steel joists and expanded metal arches, with 9 inches of concrete at the centre. In this case, however, the floor will be flush with the top of the joists, without paving; and it is believed that this will answer all purposes. An important point is that the floor will be kept up at the centre so as to resolve the horizontal thrust on to the retort-house and the retaining-wall; and thereby assist the load on the foundations.*

This description of the coal-store floor brings us again to the yard-level. But before dealing further with the upper part of the structure, there is a feature in connection with the stores which is at present regarded more in the nature of an experiment, but the conception of which and its *primâ facie* advantages deserve the realization of success. It is contemplated to form a brick tunnel with geared doors through the floor of the stores, to enable coal from any one point to be removed to the breakers, or in case of the stores being full, to enable the coal from one end to be run through to any of the other sections. The plan cannot fail also in being useful in dealing with cases of overheating. No absolute decision has yet been come to on this matter. But it will probably be tried in the No. 1 stores; and, if it proves satisfactory there, it will be extended to the second and third sections as they are built. There are many points which require careful consideration in connection with this ancillary part of the scheme; and these points make Mr. Botley and the Engineer-in-Charge rather cautious before arriving at a decision. If the idea does not after all commend itself as feasible, or if trial does not prove its expected advantages, it may be necessary, in the event of coal being worked out of one section, to elevate coal from another section of the stores to an overhead line or conveyor or transmission to the section where it is required.

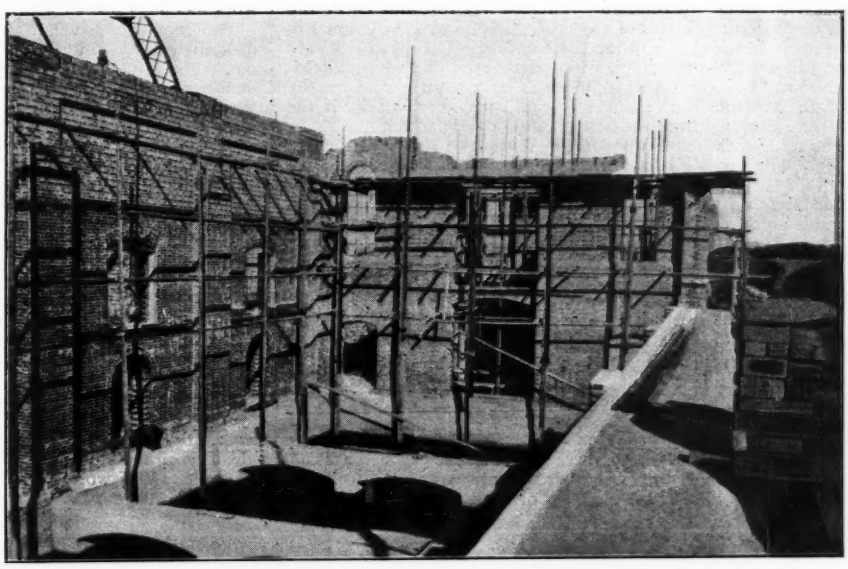


FIG. 13.—VIEW TAKEN FROM THE RETAINING WALL LOOKING DOWN INTO THE WATER-TANKS.

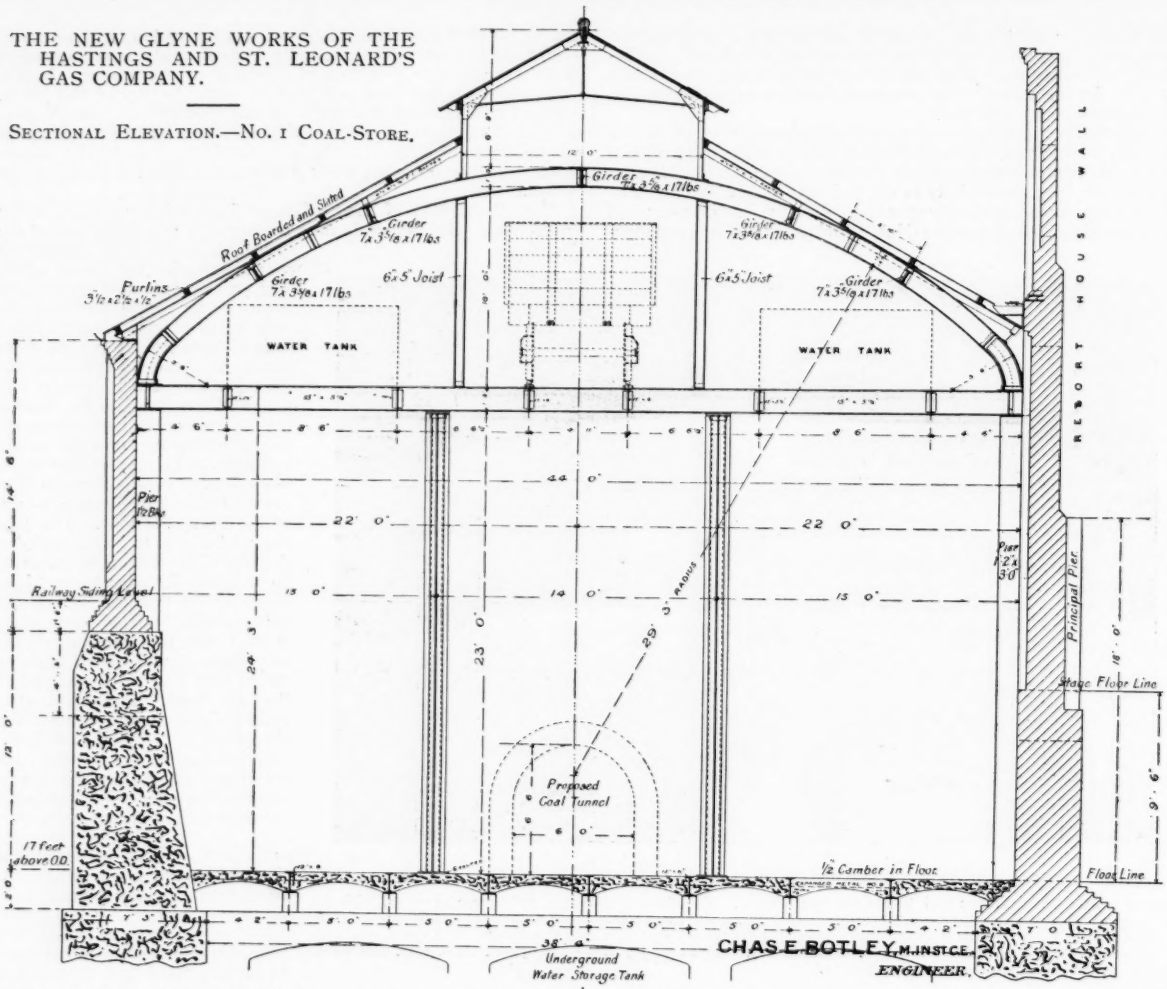
(This photograph gives a good idea of the Openings provided in the sides of the Retort-House and Lift-House. The Cross Arch Pieces are 21 feet centres, and not only form Struts for the Retaining-Wall, but also play a part in carrying the Floor of the Coal-Stores.)

With this little digression from the work actually in progress, we will return to the upper part of the coal-stores. It has only been necessary to raise the side wall above the retaining-wall some 14 ft. 6 in. This side wall is of light construction; being 18 inches thick through the piers. But it is strengthened by

* The photographic illustrations for this part of the work—figs. 10 to 13 were supplied by the New Expanded Metal Company, Limited.

THE NEW GLYNE WORKS OF THE HASTINGS AND ST. LEONARD'S GAS COMPANY.

SECTIONAL ELEVATION.—No. 1 COAL-STORE.


Roof Boarded and Slated
Purlins 5½ x 2½ x ½
Girder 7 x 3⅝ x 17 lbs
Girder 7 x 3⅝ x 17 lbs
Girder 7 x 3⅝ x 17 lbs
Girder 7 x 3⅝ x 17 lbs
Girder 7 x 3⅝ x 17 lbs
6 x 5 Joist
6 x 5 Joist
WATER TANK
WATER TANK
RETORT HOUSE WALL
Pier 7'0 x 3'0
Railway Siding Level
Pier 1'2 x 3'0
Principal Pier
29' 0" RADIUS
Stage Floor Line
Proposed Coal Tunnel
17 feet above O.D.
½" Camber in Floor
Floor Line
CHAS. E. BOTLEY, M.INST.C.E. ENGINEER.
Underground Water Storage Tank

additional piers, 3 feet wide by 1½ bricks thick, at 21 feet centres. These rise from the retaining-wall (see fig. 10), and carry the ends of the cross girders of the coal-store floor. Provision has been made in the side wall for the emptying of trucks (with side doors) direct from the sidings into the stores (fig. 13); and this method will be followed when there is only a little coal on the floor, to save the breakage which would necessarily arise if the coal were dropped from the height of the overhead line.

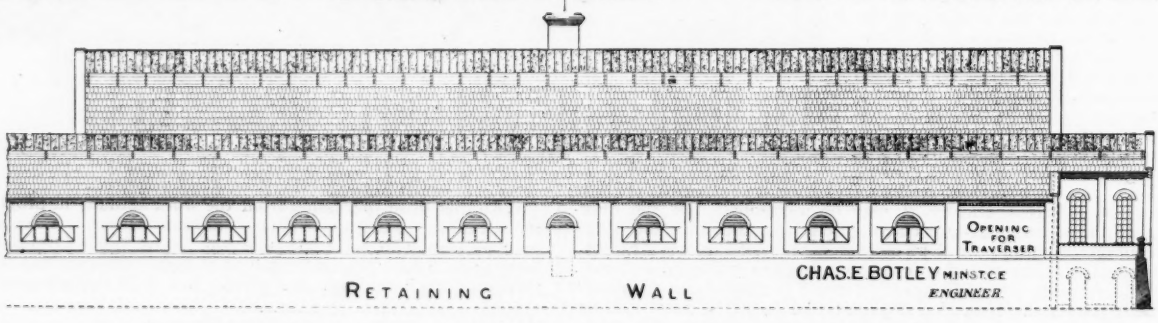
The roof of the stores is somewhat novel. It is elliptical in shape. The cross girder, which, in some senses, acts as a tie-beam for the roof principal, carries the coal-trucks and also the water-tanks on the other side—the loading being as nearly as possible equal with a full truck—that is to say, with about 20 tons of water in the tanks, there will be about 20 tons in the truck. Weight so distributed is a great advantage in dealing with moving loads. There are six lines of longitudinal joists in the staging proper. The side joists carry the tanks; and the centre joists (which are heavier) will support the rails on which the trucks will be run. It was originally intended to make the principal entirely of joists bent to suit. But on the Engineer going into the matter with the manufacturers, they thought it would not be desirable; and thus it is being constructed of two 3 in. by 3 in. angles top and bottom for the flanges, and $\frac{7}{16}$-inch steel web plate, with joints as necessary. Vertical members brace the principal and cross girders together; and these will also serve for the hand-rail, &c., in the roof. The cross girders are supported from the floor by steel columns, made up of four sections, circular in form, with riveted flanges. The contract for this portion of the work has been placed with Messrs. S. Cutler and Sons.

The roof (which will be boarded and slated in the manner described in dealing with the retort-house) is at an angle of 29°. The rafters will be supported from longitudinal girders or members of 7 in. by 4 in. joists. These members, of course, also tie the principals. The louvre will be covered by Rendel's glazing, with open sides.

COAL-HANDLING METHODS.

In the centre bay of the coal-stores, the necessary provision having been made in the side wall of the retort-house, the coal breaking and elevating machinery for feeding the latter will be located. Over the breakers, and attached to the cross girders, will eventually be large hoppers; so that the trucks on the overhead line can be emptied into these hoppers, whence the coal will be fed into the breakers or elevators, as the condition of the coal necessitates. Frequently, the coal as received is in such a fine state that passage through the breakers would be quite superfluous; and therefore a bye-pass to the elevators has been arranged.

This is an appropriate place to explain how it is proposed to work the coal from stock. The machinery will be located at the centre of each store; and the coal will either be kept in the bulk-head on either side, or it will be sloped back from the low wall, so that, in case of working from stock, it will be handy. Generally speaking, a tram or crane, with self-emptying skips (the crane



SIDE ELEVATION OF No. 1 RETORT-HOUSE AND COAL-STORE FROM RAILWAY SIDING.

by the way is now being used in the constructional work), will be employed. If the idea of the tunnel proves practicable, trams will, of course, then be used; and they will be run opposite to the breaker. There they will be elevated by means of a small hydraulic lift to such a height as will enable them to be tipped directly either into the breakers or the elevator boot. Or, following the tunnel plan, the coal can be taken into the trams or trucks on to the lift (to be next described), be raised to the elevated line, and then tipped into overhead bunkers. As a rule, however, the coal will be dealt with directly from the trucks into the breakers; and in this case, the former will be brought over the pit which is opposite the centre bay of the coal-store where the simple plan of putting a vertical ram under the axle of the truck will be employed—necessitating, of course, end-emptying waggons; but the rate of discharge can be regulated by the attendant as desired. [The trucks, by the way, will all be 10-ton ones with end, side, and bottom doors, so that they can be used as occasion requires.] From this point, trams will run across the coal-store between the breakers (which will be in duplicate), and tip either right or left; or, as is more probable when the works are in full operation, a conveyor will be utilized from the pit (which will be under the line just outside the coal-stores) to the breakers. As already mentioned, the present ideas of the Engineer favour stoking machinery driven by compressed air; but the motive power for the coal conveyors, elevators, and breakers will very likely be electric. This is a point which will be alluded to again when dealing with the power house.

The Lift-House and the Traverser.

At the east-end of the coal-stores, and forming part of the building, is found another interesting feature, and that is the house in which a truck-lift is being erected. This lift serves to connect the yard with the railway sidings, and the sidings with the overhead line in the coal-stores. This latter is necessary owing to the disadvantage of the railway being rather lower than the Engineer would have liked. As, however, the lift will be, in the usual way, automatic, and as it is combined with a turn-table, which must be used when it is desired to take trucks to the yard—this line being at right angles to the line of the sidings—not much time will be wasted in operating. Lifts, at the best of times, can only be called objectionable necessities; but to avoid as much as possible those objectionable features, and to save in the operation of the lift the human element to the greatest extent, it is being made as automatic as may be. The turn-table keeps the lift under cover; and, being hydraulically operated, a little extra weight is of no great importance. In the end of the coal-stores a secondary accumulator will be placed; and, possibly, in the first instance, power-driven pumps may be located here.

In connection with the lift, it is necessary to refer to another special feature—that is, the hydraulic traverser. This is rendered essential by the fact that, at the Gap Bridge end of the railway sidings, there were no means whereby the sidings could be connected, nor could access be obtained to the coal-store and lift. The traverser, therefore, moving in a horizontal plane, right from the main line siding to the wall of the retort-house, and carrying upon it two lines of metals with weighbridges, will inter-connect any of the four roads of sidings, and will also enable trucks to be run into the stores opposite the lift, and there be either sent to the yard or overhead to the stores. The two roads on the traverser will enable one empty and one full truck to be traversed. The traversing will be automatically arranged; and it is expected that two men will suffice for the working of the apparatus—one on, and one off. The man will start the traverser; but the stopping at any desired point will be quite automatic. It will be understood how essential this is when it is considered that the trucks must be stopped exactly opposite the other lines of metals. The traverser pit is also quite automatic—the traverser in its progress moving the stop-blocks in or out; so that the lines are only opened when the traverser is in the exact position. In addition, the weighing will be accomplished during the traversing, and so time will be saved. As the truck will pass over the traverser twice—once full and once empty—a record of both the full and the tare weights will be obtained; but eventually doubtless a truck, after once going on to be weighed, will pass to the yard level, and thence up the gradient (referred to in the second article) on to the sidings at the other end. The weigh-bridges, being self-registering, the man on the traverser will only have to stamp his ticket, and put on it the number of the truck. It may also be pointed out that the traverser, forming as it does a moving weighbridge, can be used in connection with any line, even if not employed as a traverser proper. In connection with this plant, one or two capstans will be installed. The special hydraulic machinery will be provided by Messrs. John Abbot and Co., of Gateshead.

It must be said, from an examination of the plans and the work so far as it has progressed, that the details of this interesting feature of the works as here generally described have been very carefully thought out by the Engineer. The whole of the hydraulic arrangements are necessities inherent to the circumstances of the site and the level of the railway; and the utmost circumspection has been displayed in bringing them to the highest point of completeness and usefulness.

The Coke-Handling Scheme.

As the traverser plays a part in the projected plans for dealing with the coke, this will be a convenient place to insert a little information on the subject; and for this purpose we must return to the retort-house. If conveyors are employed, they will be arranged to work in either direction; and if trams are adopted, which seems to be the system at present favoured by Mr. Botley, there will, of course, be no difficulty in this regard. If the coke is not to be loaded into railway trucks (about which more presently), it will be conveyed out of the west end of the house and across the yard, where it will be, after weighing, elevated on to a simple overhead 2-feet gauge railway. It should be explained that the boiler-house, the carburetted water-gas plant, and the coke store and breaking machinery will (unfortunately, but imperatively) be in a parallel line—not parallel with the line coming out of the house, but parallel with the house itself. The elevation of the trams will be by an automatic up-and-down lift; and the trams will be emptied into the hoppers over the coke-storage bins or over the coke-breakers, or direct into the generators of the carburetted water-gas plant, or into the bunkers of the boiler-house, so that there will be no double shifting of the coke. Should conveyors be employed, it is possible that they will not extend further than the overhead staging by the boiler-houses, or they may even stop at the end of the retort-house, where they would deliver into the trams.

Still dealing with the coke, we find at the Hastings end of No. 1 retort-house, a further feature which will be of interest to gas engineers. It is a plan which has been determined upon for dealing with the coke or any other material which may arrive at this point by the 4 ft. 8½ in. road which runs from the hydraulic lift across the ground northwards to the purifier area. In a position immediately central to the retort-house will be made a pit large enough for a railway truck to be entirely sunk into it, by means of a hydraulic ram. To this pit the coke will be brought either by conveyors or trams (being quenched *en route*, or directly it leaves the house), and tipped into the waggon. The waggon will then be raised by the ram, run to the lift, elevated to the traverser, and so be away in a very short time—in fact, when in full work, a truck can be in with coal and out loaded with coke or other material well within four or five hours. The pit is to be provided with elaborate locking gear, so that when the platform is up to the ground-line there can be no fear of any mishap. This is a point that has given a good deal of difficulty, but it has been surmounted. At the start of the works, this lowering pit will take all the coke.

THE GAS AND WATER STOCK MARKET.

(For Stock and Share List, see page 682.)

Business on the Stock Exchange reopened last Tuesday very sluggishly after the Whitsun Holidays; and a small attendance kept transactions down to a limited measure. The general feeling was not happy; and the announcement of a failure was not a pleasant beginning. Great uneasiness in the American Market, and to a lesser degree in South Africans, kept everything in a ferment, and abnormally sensitive to small influences. Prices jumped about spasmodically—up one day and down the next; but the downs were by far the stronger. In fact, with the exception of Consols, hardly anything netted a gain. The Money Market, after a little hanging-fire, moved decidedly towards pronounced ease. Supplies were abundant to meet all requirements, and discount rates relaxed considerably; and the date of the next reduction in the Bank of England rate is being discussed. In the Gas Market, business was decidedly slack and humdrum. Transactions were so limited as scarcely to afford any sure indication of a tendency either one way or the other. But so far as they went, they pointed for the most part to firmness; and of the few issues that were actually dealt in, the prices were mostly above middle figures. There were hardly any variations in the quotations; and these were comparatively insignificant. In Gas-light and Coke issues, very little business was marked daily in the ordinary at level figures; the opening and the closing marks being 86, and the variations of the week ranging only fractionally above or below this price. The secured issues were moderately dealt in at steady prices. South Metropolitan was hardly touched—only a couple of bargains being marked; but it commanded a good price. Commercials were about equally inactive. The Suburban and Provincial group continued extremely quiet; but one or two parcels changed hands at good figures, though locally Liverpool "A" was a point easier. In the Continental Companies, there was the same dearth of activity; but prices were rather better. Imperial was more than once marked at top price, and looked like advancing, and Union continued steady. There was nothing to note in connection with the remoter undertakings beyond an advance of a point in Melbourne 4½ per cents. The Water Companies were quiet at first, and rather uncertain in movement. But they soon steadied, and wound up with a smart advance nearly all along the line. Southwark was done at 272 on the opening day, and 286 at the close.

The daily operations in Gas call for no further notice. In Water, Southwark fell 1 on Tuesday. On Wednesday, Kent New rose 2½. On Thursday, Chelsea gained 5, ditto preference 3, Southwark 1, and ditto preference 1. On Friday, Southwark rose 9, and Chelsea, East London, Lambeth, and West Middlesex 5 each.

COMMUNICATED ARTICLES.

THE THEORY AND PRACTICE OF "FLICKER" OR COLOUR PHOTOMETRY.

By Jno. F. Simmance.

The "Flicker" or colour photometer is a means of extending the scope of apparatus with which we are all familiar, but which is limited in its capabilities. The ordinary photometer may be compared to a balance which will weigh an orange against an orange, but not an apple against an orange, because they are of different colours. The "Flicker" photometer is a balance that weighs irrespective of colour. This simile is not as far fetched as it appears; for colour and intensity are almost as distinct as colour and weight.

In order to clearly explain my subject, I must first of all call attention to the fact that no man has ever made or invented a photometer—a light measurer. We cannot yet, by glancing at a scale, read off light intensities as we can temperatures on a thermometer. In this instance of a thermometer, the instrument (once calibrated) automatically, and for all practical purposes infallibly, acts as a measurer requiring only a reading of its index. Many forms of apparatus come into the same class—all "meters;" but lights dimensions, so to speak, have never been determined by any humanly constructed machine.

We may split light up and distort it; but no apparatus can measure it. A moving finger may show the amount of energy required to generate or produce the light; there is no moving pointer to indicate the amount of illumination evolved. The eye, therefore, is the sole "light measurer;" and so-called "photometers" are simply means of presenting light-sources under such conditions as will bring them within the very narrow range of perception which the normal eye possesses.

That range consists of: Firstly, the power of determining that one of two lights is greater than the other; and, secondly, when two lights are equal, of being aware of the fact. If the first-named qualification were coupled with the power of determining how much the one light exceeded the other, the eye would be a perfect photometer. Unfortunately, it is not. The second-named power, however, is something definite and undeniable. The simple fact that the eye can discern positively when two light-rays thrown on adjacent and equi-coloured surfaces are exactly alike, is the key to photometry—is the only ground upon which we can stand in stating degrees of illumination. Given the decision that the lights on a certain spot are equal, we are thenceforward independent of the eyes' judgment. We have rules, formulæ, and the whole artillery of the scientist, to work out our results. But that one fundamental point, the one certainty in a sea of uncertainties, can only be indicated by the eye; and always, when we try to build up a photometrical calculation on any other foundation than that, our fabric may be elaborate and accurate, but it is built upon the sands.

I do not wish to be understood to say that a very experienced eye cannot give a very good guess at proportioning relative light-intensities; but anything like close guessing is only arrived at by a perception of facts apart from light intensities—the amount of blue in a flame, the clearness or the reverse with which objects can be perceived by the relative illuminations, the size of a flame, &c., &c. This is purely guessing; not measurement.

Therefore, a perfect photometer as a light-measurer is one which enables the one great certainty of the eye to be brought into play. A good example is the Harcourt table photometer, which,—although suffering from the small angular defect which can never be remedied until we have a standard lamp of the exact power of the light under test—is as nearly perfect on the visual point as a photometer can be. The eye is only required to decide when the rays from two sources, falling upon two similar surfaces, are equal—when the dividing line of difference is eliminated. The Bunsen disc, the Joly prisms, the Lummer-Brodhun, and others, all strive, more or less successfully, after the same object, and need not be enlarged upon here.

All this prologue, you will perceive, has but one object—namely, to emphasize the fact that the only certainty in photometry is that the eye is at its best in determining when lights are equal (*i.e.*, when both lights demand the same area of pupil-orifice, and therefore allow the same degree of sensation to reach the retina), and that, apart from this condition, the eye—sole arbiter of light-measurement—is not an instrument of precision.

The "Flicker" photometer is the outcome of many attempts to utilize this great law in photometry, when the lights being compared are not only unequal in intensity, but also in colour.

Only recently has the necessity for invention in this direction become pressing, as only recently have means been discovered by which the more rapid light-waves can be produced artificially in a form adaptable to the use of man. The general introduction of arc electric and incandescent mantle gas-lamps found the photometrist unprepared. For years, the lights requiring measurement have been of practically the same low vibration as those forming the standards of comparison—standards so rooted in Acts of Parliament, and the more recent ones so firmly planted on sound scientific basis, as probably to be beyond the possibility of revision.

The "colour difficulty" thus at once presented itself; and as the advantages of the new rapid-vibration lights became more and more apparent, the difficulty of accurately estimating the powers of such lights became more and more a source of trouble to the careful photometrist. For long, the question was one of mere academic interest; now it becomes a matter of pounds, shillings, and pence, for, broadly speaking, the price of illuminants always depends upon their power of illumination. It may well have been that the absence of the spur of necessity rendered less rapid the course of invention; for many promising forms of photometers have been left incomplete, and in their forms just stopping short of practicability. The effect—colloquially termed the "flicker"—is no new thing; and only one who like myself has made up and earnestly tried to work with all the known forms embodying it, can see how very narrowly the various schemes have missed being successful.

All, however, have worked upon the same principle; but I am inclined to think that the principle has been mis-stated. It was found that when two surfaces, each illuminated by a light of distinct and differing tint, were presented rapidly to the eye with no hiatus between, a flickering sensation was produced which vanished when the relative intensities of the two colours became equalized. The physical cause of this effect is, I think, wrongly stated. It is ascribed generally to persistence of vision; the successive images being set to occur at a slightly greater interval of time than allows of the effect of continuous light.

It may perhaps have been through miscomprehending the cause of the effect that the true lines for the construction of flicker photometers have been neglected. Be this as it may, no practical use has until now been made of the flicker-effect—indeed, it has been almost entirely ignored. Dibdin, writing on modern photometry in the early part of the present year, does not mention the subject, but only points out the suitability of the Leeson star-disc for estimating the relative intensities of differently tinted lights. It is certain that at the commencement of the present year (1903), I have failed to find a single instance of the flicker's practical use. The most eminent photometrists of England and Germany, so late as March this year, were attempting what I deem the impossible—viz., to turn the eye into a perfect photometer by asking from it judgment as to equality of intensity in two totally different and distinct colours.

The theory which I advance as explanatory of the results produced by the rapid alteration of such coloured rays is based upon the sensitiveness of the nerves controlling the pupil aperture—the diaphragm of the eye. The ultra-sensitiveness of such nerves appears to afford a complete explanation of the "flicker" phenomena. The faculty of diaphragm adjustment is being constantly exercised during our waking hours, as all objects reflect light upon the retina in various degrees, and the eye, in appreciating form and colour in objects, arranges its diaphragm to suit each, as it does its focussing power for different distances. Small as is the range of dilation and contraction, yet within it are all the graduations required for all scales of light intensities within the limits of normal sight. It may not be generally known that a photometer was actually invented that used the degrees of dilation of the pupil as a measure of intensity; and had this been practical for general use, there could be no more accurate instrument, for differently coloured lights could be as exactly measured by it as uni-colours. This Lambert photometer was, in my opinion, the forerunner of the "flicker," although probably no one has till now appreciated the likeness between the two. It is the alteration in the aperture admitting light to the retina which gives us the peculiar effect in the flicker photometer. The impossibility of the adjustment of the pupil orifice to the rapidly alternating light-powers produces the blurred, throbbing effect. The sense of colour is lost in the attempt to appreciate the intensities; and as (by the alteration of the power of one of the lights) these become less unequal, so the flickering lessons, until at last, by the arrival of the period of equality, the eye is at rest and the throbbing sensation vanishes.

When both colours are of the same intensity, it means that each reflects a similar amount of light upon the retina, quite independent of colour; and this is the condition we seek to bring about when we adjust a Bunsen disc to a position of equality with similarly-coloured lights. Obviously, the colour does not matter when we are only judging intensities; but only by the rapid alternation of the light rays can the disturbing effect of the colour be avoided. With the Bunsen or star disc, or the Lummer-Brodhun, in testing lights of different tints, the eye adjusts itself to one image and, remembering the effect, passes to the other. But the observer cannot tell whether the diaphragm has had to readjust itself to the second image. This action is so unconscious that frequently the two sides of a disc are estimated as equal in power when there is a considerable difference. I have known a difference in reading by two skilled observers (of the same lights of different tints) of 50 candles—one reading 30, the other 80. Now if each could have gauged the pupil-conditions of his eye for each light, the great difference could not occur; and therefore the flicker may be looked upon as a method of actually enabling us to perform automatically an action which cannot be performed voluntarily.

I have mentioned the nerves controlling the dilation of the pupil as being unable to work fast enough to appreciate individually the alternating lights; but it may well be that they *are* capable of so appreciating the changes, and that it is the nerve-

centres of the brain which are not sufficiently alert. If this is so, it should vary with different observers. Some persons would be able to effect far finer readings—that is, be able to detect the existence of a flicker when other experimentalists would deem the throbbing to have ceased, and the lights to be equal. I have known one case only in which the reading so differed from others; but in all others (many hundreds) the readings have coincided. We know that some abnormal brain conditions have a non-contraction of the pupil in the presence of light as a symptom. The subject is an involved one when such issues enter; and it is sufficient to state that, ordinarily, all observers make similar readings. Indeed, it seems almost impossible for variations in readings to take place; the change from the throbbing disc to the steady disc being so marked.

The points of construction which must be considered in preparing a flicker photometer are simple but important. Being so, it is extraordinary that, in the course of the seventy years during which the flicker sensation or effect has been recognized, it should not have come into general use. But the fact is that none of the forms or examples of it which were extant have complied even with these very obvious conditions. Thus it is that probably not one photometrist in five hundred has ever seen a flicker photometer in actual use.

The one guiding rule as to the efficiency or otherwise of the photometer may be stated thus: The light-effects must be side by side without any division line, and must move or oscillate so that the point of juncture of the two lights passes and returns entirely across the field of vision. This oscillation being effected in a perfectly regular manner, it follows that the light-rays alternate upon the vision-field (for each ray must be of greater breadth than the field), each having the same period of visibility. The speed of the oscillations required depends roughly upon the intensities of the lights, although there is a very wide range within which differing speed has no appreciable effect. It may almost be said that any flicker photometer to be accurate must form a perfect sighting-box, even when the slide is at rest and no oscillations are taking place; for if the junction of the two different light images is brought to the centre of the vision-field, you have the same effect as in the Foucault photometer and as in the present Harcourt table photometer. Either of these enables a perfect reading of two similarly coloured lights to be made and so should any well-designed "Flicker." It will be seen that in such a case the surfaces illuminated by the different lights are at the same distance from the eye; and this is another important point. In one of the best known "Flicker" photometers (invented by Rood), this point is ignored. The "Rood" forms are most generally known and are shown in figs. 1 and 2.

It will be seen that the rays from lights A and B (fig. 1) fall upon the revolving and the fixed surfaces at totally different distances from the eye; and this introduces a grave error, which is magnified as the disc-box moves nearer to one light and away from the other—the angle of impingement changing inversely on each side. This arrangement is a good example of an inaccurately designed photometer.

A form (fig. 2) based on the Ritchie photometer, has also had some vogue; but, by a strange misunderstanding of the essentials of a photometer, it is seriously inaccurate. By the oscillation of the lens C, the wedge D is apparently made to move from side to side, so that each angle appears to come in turn before the eyepiece E. But, as a matter of fact, the wedge does not move; and we have the error of examining for equality by measurement two lighted surfaces which are constantly at a fixed distance from each other. The inaccuracy here when one light is ten times the other amounts to nearly 10 per cent.

A form of Ritchie photometer with the wedge itself caused to vibrate is one of the most effective and correct arrangements of a "Flicker," and is described later.

The two examples given show how very nearly the problem of the accurate testing of coloured lights had been solved; and both also serve to illustrate the points mentioned as indispensable in a true photometer. The modern form, built up upon experience and strenuous testing of previous methods, avoids all the errors of its predecessors, and at last has emerged as a successful means of solving the colour difficulty in photometry.

Two of the Simmance-Abady forms of construction may be instanced, which will show clearly the points of departure from the grooves into which "Flicker" photometry appears to have sunk. The first (figs. 3 and 3A) is an arrangement* by which the light under test is first of all calibrated against a variable light, or, rather, the latter is adjusted until it equals the light under examination. This adjustable light is of the same colour as the recognized standard flames—the pentane, hefner unit, carcel, or the candle; and therefore, by means of an ordinary bar and Bunsen disc-box, can be easily photometered. This arrangement may be briefly described: On a table similar to that used for the Harcourt photometer, the two lights are placed—the one under examination (we may say an electric arc lamp) and a gas argand. The cock for the latter is at the further end of the table, where is also a screen in which a hole is pierced and in which hole is a telescopic tube with its end stopped with a disc of translucent paper. The two lights and this screen form a triangle; and thus the rays from the lights fall upon the paper disc and can be viewed from behind the screen through the tube. Covering the end of the tube, between the paper and the lights, is a shutter, slotted so that the rays pass through the slot on to the paper. Thus far the arrangement is almost exactly similar to the Harcourt photometer with its photoped. By carefully adjusting the telescopic tube, the rays passing through the slot are made to fall side by side on the paper disc; and, in the case mentioned (of an arc lamp and an argand gas-flame), the appearance is of a greenish light and a reddish one. The slotted shutter is geared to a motor, and so caused to rapidly vibrate horizontally across the paper disc, and

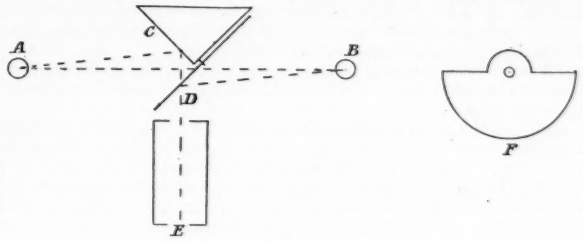


FIG. 1.

A & B, lights; C, fixed receiving surface; D, sectored revolving disc; E, sighting tube; F, design of sectored disc.

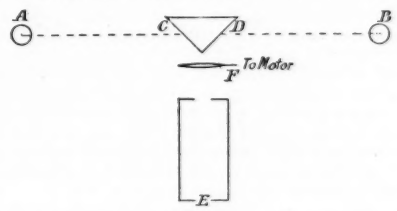


FIG. 2.

A & B, lights; C & D, fixed receiving surfaces; E, sighting tube; F, oscillating lens.

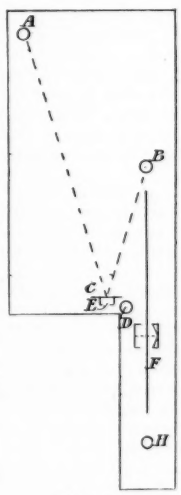


FIG. 3.

A & B, lights; C, flicker screen; D, cock to gas-burner; E, sighting tube; F, bar and disc box; H, standard of light.

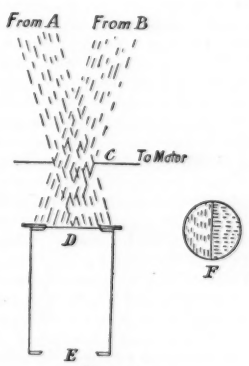


FIG. 3A.

A & B, rays from lights; C, oscillating slotted plate; D, paper disc; E, sighting tube; F, showing juxtaposition of compared lights on D.

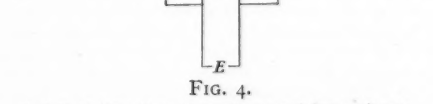


FIG. 4.

A & B, lights; C, reciprocating receiving surfaces; E, sighting-tube.

an image is thereby thrown alternately of the red and the green light. It will be found that the effect of colour at once vanishes, and only a black and white flickering light is shown on the disc. By stopping the vibration of the shutter, and slowing it down to rest, the colours will again appear, to vanish a second time when the oscillation of the shutter is recommenced. The reason, as already stated, is that the pupil of the eye cannot adjust itself to the alternating intensities, and the retina is exposed to (what it would never be exposed to in ordinary use) changes of light-intensity without the proper work of its diaphragm being carried out.

Now the argand burner cock is close at hand by the screen, and

* Described in a recent number of the "JOURNAL."

can be turned so as to lessen the difference of intensity (although practically in no way altering the colours). As the cock is gradually turned, the black and white flicker lessens and becomes a mere throbbing. At last, the paper disc is simply a steady, motionless spot of light; and although the rays of red and green are still being alternated rapidly, the eye perceives nothing but the clear shining disc. The intensities have become exactly equal, and the pupil is able to adjust itself to that particular intensity, which is not the sum of the two intensities, but of one only. The two rays are never visible together. The eye only sees one at a time; and as long as the powers are equal, the change from one to the other is quite invisible. But the power of distinguishing the colour has returned (showing that the effect is not caused by a numbing of the retina), and the disc is the perfect blend of the two colours—each contributory tint being of absolutely the same power.

If this description is followed through carefully, it will be seen how important are the rules which I have mentioned as essential to success. If any hiatus occurred between the colours, or if one was visible longer than the other (through irregular traverse), it will be obvious that the effect must be marred. Absolute accuracy of make and working is essential to success.

The result of the operation detailed above is that we have an argand flame of exactly the same power as the light under test; and if the argand has been placed at a quarter of the distance of the other, and yet the rays on the disc be equal, it follows that, by the law of inverse squares, the electric lamp is exactly sixteen times as powerful as the gas argand. To ascertain the actual power of the latter is easy; the flame being of the same colour as the standard light. Thus, a bar and the standard flame being mounted on the table in such a position that the power of the argand can be read off on a Bunsen disc, the test may be completed. The figures would stand thus, as an example: Arc lamp (say) 60 inches from the screen; argand burner, 15 inches. Ascertained power of argand, 47·5 candles. Therefore, the arc lamp is of the power of 760 candles (47·5 × 16).

The diagram (figs. 3 and 3A) explains the position of the lights, &c. The arrangement effects the accurate testing of an arc lamp, which is proved to be impossible with the usual bar and disc box.

For lights of very high power, a different arrangement can be used, by which powers up to 10,000 candles can easily be measured; and this form is made so that the light enters at right angles to the sighting-tube. Fig. 4 will explain this, which is the modification of the Ritchie already mentioned, but in which the wedge itself vibrates. A and B are the lights, and C the flicker disc-box. It will be seen that the wedge in passing to and fro presents its two sides alternately to the sighting-tube. But each is read exactly in the centre, and the angle of each side is the same; so that the errors pointed out as occurring in the old form of "Flicker" photometer are entirely avoided.

This form, being mounted in a sighting-box, can be fixed on an ordinary bar, so as to move between two fixed lights, and enable the candle powers to be read direct off a bar in the usual manner. But the vibration caused by the oscillating wedge is considerable; the majority of bars on existing photometers being slight, and not made to carry anything beyond the ordinary Bunsen box. Those possessors, however, of modern Letheby-Bunsen photometers can easily adapt the instruments to the "Flicker," and thus be able (with a 10-candle pentane lamp or a carcel) to not only carry out their ordinary illuminating power tests, but also, with perfect accuracy and ease, to test incandescent lights, coloured globes, &c., of powers up to 350 candles. A slight structural alteration will make the same class of photometers capable of testing up to many thousands of candles, and at any angle.

This accomplishment of the task which has for so long baffled the scientist, renders possible a variety of investigations into light powers. A leading firm of dry photographic plate manufacturers is now using this photometer for testing plates; samples being exposed to exactly the same power of daylight, which, through the medium of the Simmance-Abady photometer, is arrived at by comparison with a standard flame. The daylight orifice is closed down until the transmitted light equals the standard; and thus conditions can be exactly reproduced. The north light only is utilized, reflected from a prepared screen.

The most violent contrasts of colour can be balanced, and the actual combination (of exactly equal intensities) be arrived at. It would seem impossible that a complete balance should be arrived at between lights that show alternately on the photometer vivid signal red and a clear green; but the result is as easily and accurately arrived at on this photometer as when only an arc electric lamp is being compared with a gas-flame. It is, however, in such cases as this latter that the extreme usefulness of the instrument becomes apparent. Our streets are becoming more and more equipped with high-power lights, and an era of competition between intensified gas and electric lighting is setting in. The ultimate success of one or the other of these, to the entire exclusion of the other, is not likely. Both will always have their adherents; but the gaining of supporters to each system will only be accomplished by definitely proved advantages. The whole matter must be settled on one basis—cost in relation to candle power. At present, both gas companies and electric lighting authorities are acting on the "'tis better not to know" principle—like two opposing armies, in fact, each of which fears to discover the strength of the other. On both hands there is absolute ignorance as to the accuracy of the statements put forward on behalf of the other system with regard to candle power. Town after town changes from one system to the other for its street lighting without the advocates of the ousted method taking any steps to prove the statements of illuminating power made by the exponents of the conquering light. It cannot be that such a state of things will last. The recent war of lights at Grantham has shown that, with earnest effort on the part of a man who knows his business, lighting contracts may be placed on a fair and proper basis; and in the future it will be a risky matter for lighting contractors to make inaccurate estimates of the candle power of the lights they are proposing to install. So long as the colour difficulty in photometry existed, refuge could always be taken behind it; but the introduction of the perfect "Flicker" photometer has torn down the shelter, and all lights, whether intensified gas or electric, can be given their true value in English standard candles, in hefners, or in carcels.

GAS LIQUOR AS AN ADJUNCT FOR THE PURIFICATION OF WATER GAS.

By H. Leicester Greville, F.I.C., F.C.S., &c.

From the original introduction of the manufacture of carburetted water gas on a practical scale up to the present day, I have taken (no doubt in common with many others) a keen interest in its progress and development. Like many innovations of modern times, it has its advantages and its disadvantages; but to enumerate the respective *pros* and *cons* would probably be reiterating a matter of comparatively common knowledge. There are, however, several aspects of carburetted water gas specially deserving of attention. To its advantage must be credited the compactness of the plant, the readiness with which it can be brought into action, and the ease with which the illuminating power of the gas can be controlled. In addition, it has entirely replaced all other forms of enriching poor coal gas up to the parliamentary standard of illuminating power.

On the other hand, there is a disadvantage in the absence of any bye-products, except tar, and in the comparatively high cost of purification. Ordinary coal gas contains, as a rule, according to my experience, from 0·9 to 1·2 per cent. by volume of carbonic acid as it enters the purifiers. Water gas contains from 2 to 4 per cent. With regard to sulphuretted hydrogen, water gas contains a comparatively limited quantity to coal gas. Purification from sulphuretted hydrogen may possibly pay, either by the sale of spent oxide or by its use for the manufacture of sulphuric acid; but I doubt whether the profit is as great as is generally assumed, balancing the cost of raw material, and the large amount of labour expended in charging and discharging purifiers, and in repeated revivifications. Purification from sulphuretted hydrogen, however much it may cost, is what might be termed a legal necessity, as heavy penalties are incurred for the presence of the most ridiculously infinitesimal quantity. Purification from carbonic acid has no redeeming feature, except that its presence has a depreciating effect on illuminating power. The spent material has to be barged or carted away at a heavy cost, or under the most favourable conditions re-burnt, by the use of an expensive plant.

I could never quite understand why the Hills process of using gas liquor for the purification of coal gas was not more universally adopted. The principle is heating ordinary gas liquor to a temperature of from 160° to 180° Fahr., when decomposition of ammonium carbonate and ammonium sulphydrate ensues, and free carbonic acid and sulphuretted hydrogen are evolved with a little ammonia, and a solution of free ammonia is left, which, after cooling, is available, by the use of suitable appliances, for absorbing a further proportion of impurities from the foul gas—acting as an alkali, just as lime, but with the advantage of throwing less back-pressure and not creating a valueless bye-product.

The whole question seems to me to be this: Dry purification, cost of lime, oxide, and labour, *versus* liquid purification by regenerated gas liquor, cost of coke for heating, and subsequent expenditure for cooling for re-use. Possibly gas engineers are better judges of the comparative cost of the two systems of dry *versus* liquid purification than I can profess to be in my sole capacity as a chemist. In any case, any suggestion for limiting the amount of carbonic acid in crude water gas should be worthy of consideration, and I wish to place on record some experiments of my own which tend in this direction. It is a well-known fact that carbonic acid, acting on sulphides, will displace sulphuretted hydrogen with the formation of carbonates. This is true of both calcium and ammonium compounds. Normal gas liquor contains a large proportion of ammonium sulphydrate, which is decomposable by carbonic acid—ammonium carbonate being formed, and sulphuretted hydrogen liberated.

Acting on these lines, crude carburetted water gas was passed through ordinary gas liquor; and an examination of the liquor gave the following results:

Total of strength	8·4	= 1·822 per cent. NH_3
Volatile ammonia	6·25 oz.	= 1·3556 NH_3
Sulphuretted hydrogen . .	0·328 per cent.	
Carbonic acid	1·518 ,,	,,

After 75 hours' slow treatment with the gas, the liquor tested out as follows:

Volatile ammonia	1·301 per cent.
Sulphuretted hydrogen	0·050 ,, ,,
Carbonic acid	2·626 ,, ,,

After a further treatment for six hours, the liquor gave:

Volatile ammonia	1·290 per cent.
Sulphuretted hydrogen	0·050 ,, ,,
Carbonic acid	2·657 ,, ,,

The total loss of ammonia = 5 per cent.

The method of treatment was very primitive—viz., simply bubbling the gas through the liquor in the flask by means of a glass tube. No doubt, on a large scale, such an appliance as one of the Kirkham, Hulett, and Chandler washers would give more perfect and rapid action. It appears, therefore, that crude water gas is capable of expelling practically the whole of the sulphuretted hydrogen from ordinary gas liquor, and that a large proportion of carbonic acid is at the same time absorbed, and this with an exceedingly small volatilization of ammonia. The ratio of volatile ammonia to carbonic acid in the treated liquor indicates the mixture of ammonium carbonate and di-carbonate.

In the case of ordinary carbonate, 1·29 per cent. of ammonia would require 1·67 per cent. of carbonic acid. In the case of the di-carbonate, 1·29 per cent. of ammonia would require 3·34 per cent. of carbonic acid. I have little doubt that, under suitable conditions, the whole of the volatile ammonia would be converted into the di-carbonate. By treating the liquor with pure carbonic acid, I have easily obtained this result with the total expulsion of the sulphuretted hydrogen.

By the use of crude water gas in the manner indicated, there are the following advantages: Lowering the proportion of carbonic acid in a costless manner; driving sulphuretted hydrogen out of the liquor to be absorbed by oxide purifiers, and subsequently utilized; the production of a practically odourless liquor or at least one freed from the noxious smell of sulphuretted hydrogen, and the powerful smell of ammonia. The ammonia also being united to carbonic acid would minimize the loss by evaporation in storage and transit.

As the carbonic acid in the original liquor was 1·518 per cent., and in the treated 2·657 per cent., the amount of carbonic acid absorbed was 1·4 per cent.; while 0·323 per cent. of sulphuretted hydrogen was expelled.

On these figures, one gallon of 8 oz. liquor would absorb 1·2 cubic feet of carbonic acid, and lose 0·34 cubic foot of sulphuretted hydrogen; and taking 34 gallons of 8 oz. liquor as a fair yield from a ton of ordinary coal, the liquor from a ton of coal would absorb 40·8 cubic feet of carbonic acid and yield 11·5 cubic feet of sulphuretted hydrogen. This is calculated on an equal make of coal and water gas. Taking the carbonic acid in the crude water gas at 3 per cent., the figures would show a reduction of 13 per cent. I consider the matter is worth prosecuting beyond the experimental stage; but, unfortunately, I have not the appliances at my command.

Premium to Dr. Fleming.—Among the premiums awarded by the Council of the Institution of Electrical Engineers for papers and communications submitted during the past season is a premium of the value of £25 to Dr. J. A. Fleming, F.R.S., for his paper on "The Photometry of Electric Lamps," which was noticed in the "JOURNAL" for the 16th of December last.

Analyses of British Coals and Coke.—In the "JOURNAL" for the 5th ult., we noticed the issue, by the "Colliery Guardian" Company, Limited, of the first part of a series of analyses of British coals and coke now appearing in the columns of that paper. As explained at the time, the object in collecting these analyses has been to classify them in districts over the coalfields of Britain, and so place them, as regards kinds of coal, that they will form not only an exhaustive list of the particular sorts of coal and coke produced in the respective districts, but also prove of value to those connected with the trade, on account of the ease with which comparison of various coals can be made, and their marketable value computed. Part I. dealt with the fuels of Northumberland, Durham, and Yorkshire; and Part II., which has just been issued, comprises Scotland, Wales, Staffordshire, and Somersetshire.

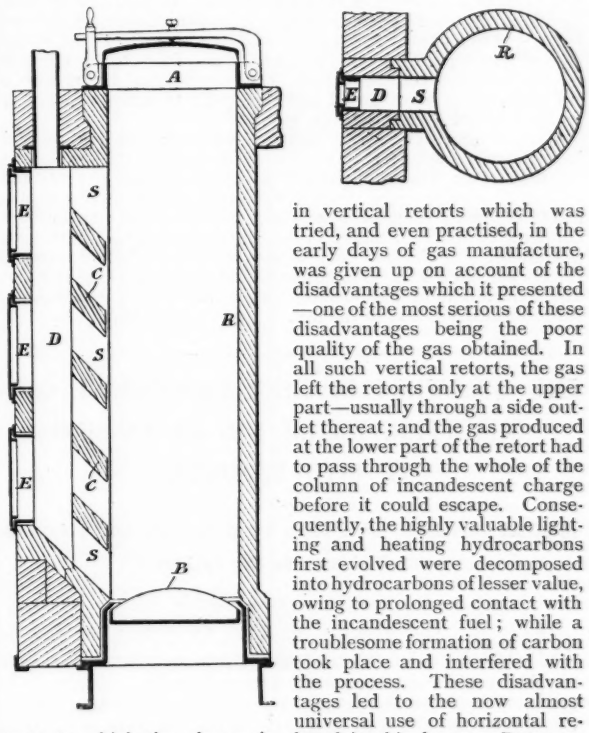
A Warning.—A Gas Engineer in the Midlands has forwarded a begging-letter addressed to him, and signed "Thos. Clarkson, B.Sc.Lond., Wh. Sc.," in which the writer states that he is a Civil and Gas-Works Engineer and an Assoc.M.Inst.C.E., who has been for upwards of two years without an engagement, through ophthalmia. Our correspondent had his suspicions regarding the genuineness of the appeal; and inquiries show these doubts to have been well founded. The man is an impostor, who has for some time past been endeavouring to obtain money in this way from engineers in various parts of the country, both under the name given above and that of "Everest." An official notice warning members against him is posted at the Institution of Civil Engineers; and as he seems now to be devoting himself to the branch of the profession in which the "JOURNAL" is more particularly interested, it may be as well to call the attention of readers to the fact that his references to the Institution are totally unauthorized, so that they may know what to do with any appeal he may address to them.

TECHNICAL RECORD.

BUEB'S VERTICAL GAS-RETORTS.

Among the specifications issued last week by the English Patent Office, was one (No. 15,154 of 1892) filed by the Deutsche Continental Gasgesellschaft and Dr. Julius Bueb, for "Improvements in, and Apparatus for, the Manufacture of Lighting and Heating Gas." Certain well-known Continental gas engineers entertain a high opinion as to the future of the vertical retort described herein—predicting that it will in many cases be preferable for use compared with either inclined retorts or horizontals worked with the best type of charging and drawing machines. On these grounds, as well as because the specification forms exceedingly interesting reading, we reproduce the document practically in full.

The patentee remarks: The manufacture of lighting and heating gas by the dry distillation of coal or other carbonaceous substances capable of yielding such gas is at the present time effected in horizontal or inclined retorts. The gasification



in vertical retorts which was tried, and even practised, in the early days of gas manufacture, was given up on account of the disadvantages which it presented—one of the most serious of these disadvantages being the poor quality of the gas obtained. In all such vertical retorts, the gas left the retorts only at the upper part—usually through a side outlet thereat; and the gas produced at the lower part of the retort had to pass through the whole of the column of incandescent charge before it could escape. Consequently, the highly valuable lighting and heating hydrocarbons first evolved were decomposed into hydrocarbons of lesser value, owing to prolonged contact with the incandescent fuel; while a troublesome formation of carbon took place and interfered with the process. These disadvantages led to the now almost universal use of horizontal retorts, in which the charge is placed in thin layers. But even in horizontal or inclined retorts, the highly valuable hydrocarbons must come in contact with the over-heated walls of the retorts before they reach the ascension-pipes; and they therefore undergo in the retort an undesirable decomposition, although this is much less than that taking place in vertical retorts.

With the abandonment of vertical retorts, a great advantage was, however, given up—namely, the easy and cheap charging and discharging of the retorts. This advantage has increased, owing to the higher cost of labour or the cost of mechanical charging and discharging devices for horizontal retorts.

This invention has for its object to provide means whereby the great advantage of the vertical retorts is secured, and their disadvantages are practically done away with. This is effected by providing a vertical retort of such form that the removal of the gas does not take place through a lateral outlet at the top of the retort, but through an outlet or outlets extending throughout, or practically throughout, the length of the retort—in communication with a passage which is not in direct contact with the furnace by which the retort is heated. The gas that is evolved from the lowermost layers of the charge can therefore escape rapidly sideways, without having to traverse a high column of incandescent charge or come in contact with extensive and highly-heated surfaces. It is thus possible to use vertical retorts of any desired height without the disadvantages that have hitherto attended their use.

The improved vertical retorts have also the advantage over horizontal retorts that the interior of the retort can be entirely filled with the charge, whereas horizontal retorts must not be more than half full, so that a sufficient space is left above the charge for the escape of the evolved gas. By the arrangement according to this invention, therefore, a much greater production

of gas is obtained than is possible with horizontal retorts of the same capacity.

The proposed construction is illustrated in vertical and cross section of the retort.

The vertical retort R may be of fire-bricks, or other suitable material, whose external surface is in contact with the fire. The retort protrudes beyond the roof of the furnace, and is provided at top with a cover A; the lower part resting on girders, and being fitted with a closing device B, which, on being opened, allows of the solid residue resulting from the distillation dropping from the retort. The retort, along the greater part of its height (a part equal, or about equal, to that exposed to the fire), is provided, on one side, with an outlet in the form of a slit S in direct communication with a collecting-passage D formed in the furnace-wall, and thereby protected against the direct action of the fire. In order to prevent the charge from falling into the collecting passage through the slit when the retort is being charged, the slit is provided with partitions C, inclined downwards towards the inside of the retort. The collecting passage D is connected with the hydraulic main, and is provided on the side opposite to the slit S with openings and removeable covers E, to enable the collecting passage and the slit to be cleaned.

The cross section of the retort R may be of circular, elliptical, or any other suitable shape. The retort (especially if small) may be made in one piece, but, if large, it may consist of a number of lengths secured together; and several retorts may be placed in the same furnace. The vertical lateral slip may be replaced by side openings arranged one above another, and be of any convenient form; but in all cases the gas evolved from the greater part of the charge, and especially from the lower layers of the charge, escapes readily and by a very short path from the vertical retort into a collecting passage protected against the direct action of the fire, and connected to the hydraulic main.

The patentees claim: (1) In the manufacture of lighting and heating gas, causing the gas to pass directly from the part of the retort in which it is produced into a collecting passage protected against the direct action of the fire, so that the gas as it it is produced is rapidly removed from the influence of the incandescent contents of the retort and injurious decomposition of the gas prevented. (2) For the purpose described and claimed, vertical retorts provided with openings or passages arranged laterally, or one above another, and opening into a collecting passage out of range of direct action of the fire.

THE DELLWIK-FLEISCHER PROCESS OF CARBURETTING WATER GAS BY PASSING IT INTO RETORTS.

[Abstract Translation of a Paper by M. Lecomte read before the Société Technique du Gaz en France.]

(*Concluded from p.* 447.)

The programme which was drawn up for testing the value of the Dellwik-Fleischer self-carburetting process required a number of calorimetric and photometric tests and analyses of gas to be made, and the apparatus used for the purpose comprised: (1) Orsat's gas analysis apparatus. (2) Bunte's burette, as used on the gas-works. This was not found to give results so quickly, nor to be quite so reliable, as the Orsat's apparatus, and it was therefore finally given up in favour of the latter. (3) Dumas' and Regnault's photometer, with Carcel lamp standard mounted on a balance, Foucault's screen, and the Bengel burner. The meter used belonged to the gas-works. (4) Elster's photometer, which is the standard German apparatus, and comprises a meter, a standard Elster burner, and a Lummer and Brodhun photometer mounted on the same carriage as the standard Hefner amyl-acetate lamp. (5) Junkers' calorimeter, with meter and balance. The Dumas and Regnault photometer was placed in a cellar below the Elster photometer. There were two gas-services to the photometers—one taking gas from the inlet main of the station meters, the other tapped the distributing main to the town. The same gas was tested at the same time in the two photometers.

Tests of the simple coal gas were made on the 19th and 21st of November. The manufacture of water gas was stopped at seven, and the tests were made from nine a.m. The samples were drawn from the inlet of the station meters, and the different qualities found were dependent on the time which had elapsed since the retorts were charged. The barometer stood at 759 mm. (29·88 inches); and the temperature of both the gas and room was 64·4° Fahr.

The gas used in tests Nos. 3 and 5 of the next table was analyzed, and found to contain 1·7 per cent. of carbonic acid, and 9·8 per cent. of carbonic oxide.

With regard to the water-gas plant, it was proved by taking through an iron pipe samples of the products escaping during the "blow," that, as the inventor claims, there was no loss of carbonic oxide. One sample of these "blow" products taken before the cessation of the "blow"—that is to say, a few seconds before the gas ignited at the outlet—had the following composition in volumes per cent.: Carbonic acid, 19·5; oxygen, 0·5; carbonic oxide, 0·5; nitrogen, 79·5. Another sample, taken after the gaseous products of the "blow" had ignited (the "blow" having been purposely prolonged), consisted of: Carbonic acid, 18 per cent.; oxygen, 0·5 per cent.; carbonic oxide, 1·5 per cent.; and nitrogen, 80 per cent. It follows, therefore, that if the blast is stopped immediately the gaseous products ignite at the outlet, no carbon is lost.

Neat Coal Gas.

Test No.	Photometrical Results.				Junkers' Calorimeter.	
	Dumas and Regnault Photometer.		Elster Photometer.			
	Consumption per Carcel. litres = cubic feet.		Hefners per 150 litres. =	Candles per 5 cub. feet.	Calories per cub. metre. =	B.T.U. per cub. foot.
1	164	5·79	7·3	6·04	—	—
2	138	4·87	11·0	9·12	5,080	571
3	116	4·10	14·5	12·00	5,282	594
4	109	3·85	15·4	12·75	—	—
5	108	3·81	15·5	12·83	5,454	613
Average.	127	4·48	12·75	10·55	5,306	596

The water gas, as made one minute after the end of the "blow," consisted (in percentages by volume) of: Carbonic acid, 2 per cent.; oxygen, 0·0 per cent.; carbonic oxide, 44 per cent.; and nitrogen and hydrogen, 54 per cent. One minute before the end of the run, its composition was: Carbonic acid, 8 per cent.; oxygen, 0·0 per cent.; carbonic oxide, 32 per cent.; and nitrogen and hydrogen, 60 per cent. The water gas, sampled at the relief holder, had the average composition of: Carbonic acid 4 per cent.; oxygen, 0·0 per cent.; carbonic oxide, 38 per cent.; nitrogen and hydrogen, 58 per cent. Two tests of calorific power gave as results 2512 and 2522 (mean 2517) calories per cubic metre = 283 B.T.U. per cubic foot. The amount of nitrogen in the gas was about 5 per cent.

Tests were made on the mixed coal gas and water gas between two and five p.m. on the 21st of November. The samples were taken before the gas passed into the station meters, and consequently before it had been carburetted with benzol. In these tests it had to be remembered that, as in the tests on the simple coal gas, there was about 1·5 per cent. of nitrogen derived from the air added to the gas at the inlet to the purifiers; and this lowered the calorific power of the gas by about 75 calories per cubic metre (8·4 B.T.U. per cubic foot). The following were the results of the tests on this mixed gas:—

Mixed Gas—Uncarburetted.

Test No.	Composition of the Gas. Volumes per Cent.				Photometrical Results.				Junkers' Calorimeter.	
					Dumas and Regnault Photometer.		Elster Photometer.			
	Carbonic Acid.	Oxygen.	Carbonic Oxide.	Other Constituents.	Consumption per Carcel		Hefners per 150 litres.	Candles per 5 C. Ft.	Calories per Cubic Metre.	B.T.U. per Cubic Foot.
					litres =	C. Ft.				
1	2·0	0·5	18·0	79·5	150	5·30	9·7	8·03	4795	539
2	—	—	—	—	134	4·73	11·25	9·32	4796	539
3	2·5	0·5	17·5	79·5	127	4·48	12·3	10·18	4847	545
Average.	—	—	—	—	137	4·84	11·08	9·18	4812	541

Mixed Gas—Carburetted.

No. of Test.	Composition of the Gas in Volumes per Cent.				Photometric Results.				Junkers' Calorimeter.	
					Dumas and Regnault Photometer.		Elster Photometer.			
	Carbonic Acid.	Oxygen.	Carbonic Oxide.	Other Constituents.	Consumption per Carcel.		Hefners per 150 Litres.	Candles per 5 Cubic Feet.	Calories per Cubic Metre.	B.T.U. per Cubic Foot.
					Litres	Cubic Feet.				
1	1·8	0·8	17·4	80·0	127	4·48	12·8	10·6	4,917	552
2	..	..	..	..	124	4·38	13·0	10·8	4,953	556
3	2·0	0·5	19·0	78·2	122	4·31	13·5	11·2	4,977	559
Aver. .					124·3	4·39	13·1	10·85	4,949	556

Tests were made on the morning and afternoon of the 22nd of November on the mixed gas after it had been carburetted with benzol. The gas was sampled at a pipe which tapped the distributing main leading to the town. The results of these tests are shown in the last table on p. 668. The temperature of the gasholder ranged from 34° to 39° Fahr., but in the testing-room it was 64½° Fahr.

The following abstract from the works' records at Remscheid gives some interesting particulars :—

Month of 1902.	Gas Made.		Percentage of Water Gas.	Illuminating Power.		Benzol Used.	
	Coal Gas. Cubic Feet.	Water Gas. Cubic Feet.		Hefners per 150 Litres.	Candles per 5 Cubic Feet.	Total Cwts.	Ounces per 1000 Cubic Feet.
September .	7,214,000	2,930,300	28·7	13·1	10·85	57·57	10·17
October . .	8,973,000	3,627,800	28·6	13·4	11·10	76·76	10·83

Total gas made: September, 10,144,000 cubic feet; October, 12,601,000 cubic feet.

The make of gas per ton of coal carbonized was 9653 cubic feet in September, and 9401 cubic feet in October. The total production of coke amounted to 75 and 70 per cent. of the weight of coal carbonized, and the coke available for sale to 58 and 57·6 per cent. for the two months respectively. The tar amounted to 4·5 and 4 per cent., and the liquor to 15 per cent. (in both months) of the coal carbonized. The make of water gas per ton of coke consumed in the generator and boiler was 40,010 cubic feet in September, and 40,370 cubic feet in October, which figures are equivalent to consumptions of 56·06 lbs. and 55·56 lbs. per 1000 cubic feet of water gas made.

It is a very simple matter to calculate the proportion of water gas in the mixture, provided the proportions of carbonic oxide in the components of the mixture are known. Thus with 9·8 per cent. of carbonic oxide in the coal gas, and 38 per cent. in the water gas, and with the average percentage in the mixed gas $(17{\cdot}4 + 19) \div 2 = 18{\cdot}2$, it follows that the proportion of water gas in the mixture would average 29·7 per cent. The monthly returns showed an average proportion of 28·65 per cent. of water gas in the mixed gas; and this figure differs by only about 3 per cent. from that found from the analytical data.

Mr. Paterson showed by experiments reported in 1901 that the illuminating power of a mixture of coal gas and water gas is proportional to the percentage of coal gas in the mixture, provided the two gases are mixed in the holder. Accepting his conclusion, it follows that it is possible at once to calculate the gain in illuminating power which results from passing the water gas into the retorts. For instance—

	Hefners per 150 Litres.		Candles per 5 Cb. Ft.
The illuminating power of the neat coal gas was	12·75	..	10·55
The percentage of coal gas in the mixture was 100 − 29·7 = 70·3			
Hence the theoretical (proportional) illuminating power of the mixture should be . .	9·00	..	7·45
While the actual illuminating power obtained in the trial from the mixture of coal gas and uncarburetted water gas was	11·08	..	9·18

This represents a gain of 2·08 Hefners, or 1·73 candles, or a little over 23 per cent. more than the calculated illuminating power for the mixture. For a similar proportion of water gas, Professor Lewes found a gain of 33 per cent. in the number of cubic feet-candles per ton of coal. This is a very similar conclusion; as his figures indicate a gain of 23·4 per cent. on the original illuminating power of the coal gas, and consequently confirm the author's results.

The data obtained in the investigations also admit of the gain of calorific power being readily calculated in the same manner as the gain in illuminating power. For instance—

	Calories per Cubic Metre.		B.T.U. per Cubic Foot
The calorific power of the neat coal gas was . .	= 5,306	=	596
,, ,, ,, ,, water gas ,, . .	= 2,517	=	283
,, ,, ,, ,, mixture was actually	= 4,812	=	541
,, ,, ,, ,, ,, calculated according to the proportions of constituents should be	= 4,477	=	503
There was therefore a gain of	= 335	=	38

The gain in calorific power thus amounted to about 7½ per cent. The advantage of the self-carburetting process can be made evident in another manner—*i.e.*, by assessing the gain in proportion to the falling off in calorific power consequent on the introduction of water gas into the mixture. For example, the falling off in calorific power should, according to the calculated proportional values, be 5306 − 4477 = 829 calories per cubic metre; while the falling off actually observed was 5306 − 4812 = 494 calories. Consequently, the difference, or gain, is 829 − 494 = 335 calories per cubic metre, or 38 B.T.U. per cubic foot, representing an advantage or calorific increase of 40·3 per cent. due to self-carburetting.

The determination of the amount of hydrocarbons absorbable by bromine affords another means of verifying the gain in illuminating power which ensues on passing the water gas into the retorts. The highly illuminating hydrocarbons are thereby carried away before they are decomposed by contact with the sides of the retorts. For instance, on Jan. 24, 1903, the coal gas at the Remscheid Gas-Works had an illuminating power of 13 Hefners (per 150 litres) or 10·75 candles (per 5 cubic feet); and the hydrocarbons absorbable by bromine amounted to 3·5 per cent. The calorific power of the gas was 5150 calories per cubic metre, or 578 B.T.U. per cubic foot. The mixed gas, uncarburetted, contained 28·5 per cent. of water gas, and had an illuminating power of 11 Hefners or 9·11 candles, a calorific power of 4900 calories per cubic metre or 550 B.T.U. per cubic foot, while 3·1 per cent. of its volume was absorbable by bromine. The gain in illuminating power over the proportional calculated value of the mixed gas was 1·7 Hefners or 18 per cent.; while the gain in bromine absorption over the calculated proportional absorption was 0·6 volume, or 24 per cent. The gain in calorific power was similarly 505 calories per cubic metre, or 11·7 per cent. These results show that, either through the description of coal carbonized or through the different behaviour of the setting, the passage of the water gas results in a greater production of methane and ethylene, for the illuminating power had gained only 18 instead of 23 per cent., while, on the other hand, the calorific power had gained 11·7 instead of 7·5 per cent. as previously. The increase of 0·6 volume in the percentage of hydrocarbons absorbable by bromine corresponds tolerably well with the gain in illuminating power observed.

Investigations made at Guestrow with a Dellwik-Fleischer apparatus on the gain which results when the water gas is added to the coal gas in the hydraulic main, show that it is inappreciable. Thus the neat coal gas had an illuminating power of 13 Hefners or 10·75 candles, and a calorific power of 5150 calories per cubic metre, or 578 B.T.U. per cubic foot. The mixture, with 30 per cent. of water gas admitted at the hydraulic main, had an illuminating power of 7·5 Hefners, or 6·21 candles, and a calorific power of 4450 calories per cubic metre, or 500 B.T.U. per cubic foot. On calculating the illuminating power on the basis of the proportions of the two gases, it comes out at 9 Hefners, or 7·45 candles; while the calorific power similarly calculated is 4350 calories per cubic metre. There is therefore no advantage to be gained by mixing the gas in the hydraulic main. Moreover, the researches of St. Claire Deville have shown that all the tar available in the hydraulic main would not yield 1 oz. of benzol per 1000 cubic feet of gas.

The method of carburetting ordinarily employed in Germany is, as in France, by the use of benzol. This is used because, in the first place, petroleum products are fettered by a very high customs duty, and, in the second place, their enriching value is only one-third that of benzol. It will be seen from the table already given that carburetting by means of benzol raised the quality of the gas from 137 litres to 124·3 litres per carcel, or from 11·08 Hefners (= 9·18 candles) to 13·1 Hefners (= 10·85 candles); and the monthly returns quoted above show that the amount of benzol used was 10·55 oz. per 1000 cubic feet of gas. The author stated, in a paper which he presented at the Congress in 1901, that it required an addition of 9·90 oz. of benzol to raise 1000 cubic feet of gas from a quality of 137 to 124 litres per carcel. It is satisfactory to obtain so near an agreement between these figures and the Remscheid quantities. The amount of benzol used corresponds to 35·7 oz. per cubic metre of neat water gas. If it is desired to raise the gas from the quality of 124·3 to that of 105 litres per carcel, it is necessary, according to the author's calculations, to add 20·5 oz. of benzol per 1000 cubic feet of mixed gas, or 69·3 oz. per 1000 cubic feet of neat water gas. It should be pointed out that the total of 35·7 + 69·3 = 105 oz. of benzol per 1000 cubic feet of neat water gas, which is required to bring the gas up to a quality of 105 litres per carcel, confirms results obtained by the author in collaboration with M. Desvignes, which were reported in a note on "Carburetting Gas by Means of Benzol" presented at the Congress of the Society in 1902.*

The Remscheid investigations have therefore led to the following conclusions :—

(*a*) The "blow" products of the Dellwik-Fleischer apparatus consist of carbonic acid and nitrogen only. The maximum quantity of heat capable of development is thus stored in the coke; and as producer gas is not made, the "runs" occupy very much more time than in any other system.

(*b*) About 53 lbs. of coke may be taken as the total fuel required for making 1000 cubic feet of simple water gas according to the Dellwik-Fleischer process. This includes the coke required for the boiler for supplying steam to both the generator and the steam-engine which drives the blower.

(*c*) The gain in illuminating power of a mixture of 70 per cent. of coal gas and 30 per cent. of water gas by the adoption of the self-carburetting method is from 23 to 25 per cent. as compared with the illuminating power of the gases, mixed in the same proportion, when the introduction of the water gas is effected at the hydraulic main or some other point in the manufacturing plant. The gain of 25 per cent. in illuminating power is a maximum for the proportion of 30 per cent. of self-carburetted water

* See "JOURNAL," Vol. LXXX., p. 92.

gas. It falls to 18 per cent. for a proportion of 25 per cent. of water gas in the mixture.

(*d*) The gain in calorific power under similar conditions, and for a proportion of 30 per cent. of water gas, ranges from 7·5 to 11·0 per cent.

(*e*) The introduction of the Dellwik-Fleischer process of self-carburetting has effected an important decrease in the carbon deposited in the retorts, and has completely done away with the stoppage of ascension-pipes.

(*f*) Benzol constitutes the most potent, most convenient, and cheapest means of enriching coal gas and water gas. The proportion to be added per 1000 cubic feet of neat water gas in the mixture to raise it up to a quality of 105 litres per carcel is from 85 to 105 oz. (according to the quality of the coal gas).

(*g*) For questions relating to the carburetting of a mixture of coal gas and water gas, the calculations and figures given for coal gas in the author's communication on "Carburetting Gas by Benzol" to the Congress of the Society in 1901 should be applied.*

(*h*) The deposition of iron carbonyl on incandescent gas mantles has never been observed at Remscheid. Further, the light produced by incandescent burners there seemed more brilliant and whiter than that from incandescent burners supplied with coal gas. Even with the argand type of burners, the flame was very much whiter, more brilliant, and shorter than that of coal gas. The reason of this improvement in the quality of the light seems to be the higher temperature of the flame of the mixture of coal gas and self-carburetted water gas.

THE SELF-CARBURETTING OF WATER GAS IN GAS-WORKS.

The following is an abstract translation of a communication by Herr H. Dicke, the Chief Engineer of the "Frankfort Water-Gas Syndicate (Dellwik-Fleischer System)," to the "Journal für Gasbeleuchtung" of May 23.

Professor Vivian B. Lewes has already published the experimental data which he obtained at the Crystal Palace Gas-Works on self-carburetting; † and Herr Borchardt, Manager of the Remscheid Gas-Works, has communicated the results obtained through its introduction at those works ("JOURNAL," Vol. LXXX., p. 1623; also compare *ante* pp. 447, 668). There are now two other German towns which are provided with water-gas on the Dellwik-Fleischer system for self-carburetting according to the Lewes process. These towns are Güstrow in Mecklenburg-Schwerin, and Ludwigshafen-on-the-Rhine. In a few months time, self-carburetting will be in operation at Berne; while other German towns have decided on introducing it. After Professor Lewes had applied the process at the Crystal Palace Gas-Works in the first instance, it was of supreme importance that self-carburetting should be carried out under German conditions, and therefore the author started at their experimental works at Frankfort extended trials with a setting of eight retorts 9 ft. 10 in. long. The Frankfort Gas Company were kind enough to place at disposal for the trials their experimental coal-gas plant—comprising a setting of eight retorts with gaseous firing, and the complete equipment of a gas-works, including a holder of 35,000 cubic feet capacity; and a complete water-gas plant was erected by the Syndicate, having a productive capacity of about 7000 cubic feet per hour. The assistance given by the Frankfort Gas-Works was extremely valuable, as it enabled the trials of self-carburetting to be carried out from the outset with the complete gas-works equipment.

The trials at Frankfort, as well as at Remscheid and Güstrow, were mainly conducted by the Syndicate's Engineers—Herr Spitzer and Dr. Messerschmitt—who displayed untiring zeal for many months. Notwithstanding that very valuable material was collected on the details of the method of self-carburetting during these trials, yet it was found that the working fluctuated so very much—despite the good and complete gas equipment and the exactness of the observations made—that it was impossible to publish precise figures with respect to it. The fluctuations of working were chiefly to be ascribed to the retort-setting standing apart and exposed on all sides, so that it was very difficult to maintain the temperature of the setting constantly. Naturally, therefore, the gas varied very much in composition, and hence in both heating and illuminating power, and it was not possible to determine positively whether a rise or fall in calorific and illuminating power was due to the self-carburetting or to the fluctuating behaviour of the setting. In order therefore to secure more unimpeachable data, the best thing which could be done was to embody self-carburetting in gas-works working on a large scale.

Herr Croissant (the Manager of the Ludwigshafen Gas-Works), and Herr Borchardt (the Manager of the Remscheid Gas-Works), who wished to be present at the trials at Frankfort, not only followed them with great interest, but satisfied themselves from them of the advantages of self-carburetting, and even before the trials were concluded, decided to introduce the process at their own works. Herr Borchardt adapted, one after another, the whole of his settings—those of horizontal as well as those of inclined retorts—for self-carburetting, and reported the results, as already stated (though only in regard to horizontal retorts). Herr Borchardt has been first in Germany in carrying out self-carburetting on the large scale—for the entire working of his gas-works; and he has shown that, with the simplest mode of procedure, upwards of 50 per cent. of water gas added to the coal gas has not caused the slightest trouble in the town. He deserves hearty thanks for his energetic action and his kindness in allowing the Dellwik-Fleischer Syndicate to continue its observations at his works. These observations also established, *inter alia*, that as much as 15 per cent. of water gas could be passed through the retorts, without subsequent addition of benzol, and the mixed gas would have the same illuminating power as the coal gas. Thus the mixed gas would be of about 14 Hefners per 150 litres (11·6 candles per 5 cubic feet) in illuminating power, as has already been published by Herr Borchardt.

The working of the self-carburetting process at Remscheid has also furnished many hints for the perfecting of the self-carburetting apparatus. At first there were difficulties in passing the water gas into the retorts in uniform streams, which naturally was one of the primary conditions for good self-carburetting. This difficulty has been entirely overcome by a very simple arrangement, without the cost of wages having been raised in the least. On the introduction of self-carburetting, therefore, the Güstrow Gas-Works were able to work, even at the outset, according to a fixed programme, and with the appropriate arrangements. In other words, the working at Güstrow was arranged more definitely and certainly, as will be shown fully later on. It was at Güstrow therefore that it first became possible to prove beyond question the superiority of self-carburetting—*i.e.*, the direct introduction of blue water gas into the retorts—over the introduction of blue water gas into the hydraulic main. The prevailing working conditions at Remscheid had made it much more difficult to prove this from the working there. Exact comparative trials, under similar working conditions and directed to this object, gave the following average results. Special attention was given to the proportions in the mixture (50 parts of water gas to 100 parts of coal gas) and the temperature of the setting being uniform.

(A).—*Self-Carburetting for a Working Period of Five Days.*—With an addition of 50 per cent. of water gas and 8·5 oz. of benzol per 1000 cubic feet of the mixed gas, on the average, a gross calorific power of 4685 calories per cubic metre, or 526 B.T.U. per cubic foot, was obtained, and an illuminating power, in an argand burner, of 9 Hefners per 150 litres (7·45 candles per 5 cubic feet).

(B).—*Passing Blue Water Gas into the Hydraulic Main.*—In order to obtain the same number of units of heat and of illuminating power as in (A), 38 to 40 oz. of benzol per 1000 cubic feet of the mixed gas had to be added.

Thus the self-carburetting saved about 30 oz. of benzol per 1000 cubic feet of mixed gas. This saving signifies, with benzol costing about 11s. 2d. per cwt., about 2¼d. per 1000 cubic feet of mixed gas. The coal used at Güstrow was English (Pelton-Main); and the coal gas obtained from it had a composition of—

Hydrogen (H_2)	54·5 per cent.
Marsh gas (CH_4)	29·0 ,,
Heavy hydrocarbons (C_nH_m)	1·5 ,,
Carbonic oxide (CO)	4·6 ,,
Carbonic acid (CO_2)	1·9 ,,
Oxygen (O_2)	0·4 ,,
Nitrogen (N_2)	8·0 ,,

The illuminating power of this gas in an argand burner, at a consumption of 150 litres per hour, was 10 Hefners (8·28 candles per 5 cubic feet), and the calorific power was 5115 calories gross and 4500 calories net per cubic metre (574 and 505 B.T.U. per cubic foot). The settings at Güstrow were always at very high heats. The charges were worked off in six hours, and amounted to 375 to 400 lbs. per retort. Air to the extent of 2 per cent. was always added to the crude gas (and afterwards to the mixed gas) anterior to the condensers.

The water gas employed in the trials was introduced into the retorts in an unpurified state, and had a composition of—

Hydrogen (H_2)	49·0 per cent.
Marsh gas (CH_4)	0·5 ,,
Carbonic oxide (CO)	40·5 ,,
Carbonic acid (CO_2)	3·5 ,,
Nitrogen (N_2)	6·5 ,,

At the outset, 50 per cent. of water gas was added continuously; and the mixed gas distributed to the town was found, from the analyses and calorimetric and photometric observations which were made daily, to have great uniformity. The analyses showed that the purified mixed gas, as distributed, had the following average composition:—

Hydrogen (H_2)	50·5 per cent.
Marsh gas (CH_4)	21·4 ,,
Heavy hydrocarbons (C_nH_m)	2·0 ,,
Carbonic oxide(CO)	16·4 ,,
Carbonic acid (CO_2)	1·7 ,,
Oxygen (O_2)	0·3 ,,
Nitrogen (N_2)	7·7 ,,

On the average, 8·5 oz. of benzol were added per 1000 cubic feet to the foregoing mixed gas before it entered the holders. The gross calorific power, determined by a Junkers' calorimeter,

* See "JOURNAL," Vol. LXXVIII., p. 208. † *Ibid*, p. 623.

was 4685 calories per cubic metre (526 B.T.U. per cubic foot), and the illuminating power was 9 Hefners per 150 litres (7·45 candles per 5 cubic feet per hour).

A comparison of the analyses of the coal gas, water gas, and mixed gas admits of the change in the composition of the mixed gas which is induced by self-carburetting being ascertained. For instance, in the appended table the mixed gas has been calculated to consist of 2 parts of coal gas to 1 part of water gas.

Constituents.	Composition (Vols. per Cent.)		Alteration.
	Calculated from the Analyses of Coal Gas and of Water Gas.	Found by Direct Analysis.	
Hydrogen	53·1	50·5	− 2·6
Marsh gas	19·5	21·4	+ 1·9
Heavy hydrocarbons .	1·0	1·75	+ 0·75
Carbonic oxide . . .	16·9	16·4	—

The benzol added for carburetting, amounting to 0·3 volume per cent., has been deducted from the amount of heavy hydrocarbons found in the mixed gas in order to arrive at the figure here taken for comparison.

Passing on to consider the composition of the coal gas by itself, the following table depicts the change effected by self-carburetting, if the composition actually found and that calculated from the analyses of the mixed gas (after deducting the water gas) are regarded:—

Constituents.	Composition (Vols. per Cent.)		Alteration.
	Normal Coal Gas.	Self-Carburetted Coal Gas.	
Hydrogen	54·5	50·5	− 4·0
Marsh gas	29·0	32·0	+ 3·0
Heavy hydrocarbons .	1·5	2·6	+ 1·1

It follows from this that self-carburetting results in a considerable increase in the marsh gas and heavy hydrocarbons, and a decrease in the hydrogen. The reasons of this phenomenon depend on both the marsh gas and the heavy hydrocarbons having been protected from decomposition, owing to the flushing effected by the introduction of the water gas, and the consequent curtailment of the time which they remain in the retort and the reduction in their contact with the hot walls of the retort. The alteration is also shown in another direction, as self-carburetting results in the deposition of carbon on the upper walls of the retorts being greatly diminished. The calculations in question are fully confirmed by the results of the calorimetric tests. For instance, if the composition of the mixed gas is calculated by adding together the proportionate values of its constituent coal gas, water gas, and benzol, the following figures are obtained:—

—	Calories per Cubic Metre.	Calories.
Coal gas	5115 × $\frac{2}{3}$ =	3410
Water gas . . .	2650 × $\frac{1}{3}$ =	883
	Calories per gramme.	
Benzol	10 × 8½ grms =	85
	Total . .	4378 calories *

(* equals 491½ B.T.U. per cubic foot gross)

But the gross calorific power of the actual mixed gas was found by a Junkers' calorimeter to be 4685 calories, which is a gain of 4685 − 4378 = 307 calories per cubic metre (34½ B.T.U. per cubic foot) due to self-carburetting by adding 50 per cent. of water gas to the coal gas.

Date 1903.	Ounces of Benzol per 1000 Cubic Feet of Mixed Gas.	Gross Calorific Power of the Gas Distributed.		Illuminating Power.	
		Calories per Cubic Metre.	B.T.U. per Cubic Foot.	Hefners per 150 Litres.	Candles per 5 Cubic Feet.
Feb. 17	20	4650	522	7	5·8
,, 18	16	4575	514	6	5·0
,, 19	32	4770	536	10	8·3

As not the slightest difficulty was found in the town of Güstrow from the self-carburetting with an addition of 50 volumes of water gas to 100 volumes of coal gas, and as the Welsbach light appeared to be considerably better than it was previously with coal gas, higher proportions of water gas were added for some weeks. But as these higher proportions still caused no difficulties, &c., in the town, the gas-works management there carried out a trial (suggested by the author) of adding 100 per cent. of water gas to the coal gas—that is to say, using equal volumes of coal gas and water gas. This trial lasted for three days; and the town of Güstrow during that time was supplied with such gas. This result must have extraordinary significance, for it shows how great are the differences in gas consumption which a water-gas plant is in a position to take up, and to what an extent it can, in special circumstances, approach the make of a coal-gas works without any changes being required in the existing gas-fittings. These facts alone must serve to settle the erection of water-gas plant, and to show clearly the great practical advantages of such plant in the working of a coal-gas works. In this trial also six hour charges weighing about 375 lbs. were adopted. The results are shown in the preceding table.

On each of these three days water gas was added to the coal gas in approximately equal volumes with the latter. The last trial shows the gain from self-carburetting under these conditions to be as follows: The mixed gas on this day consisted of 51·7 volumes of coal gas and 48·3 volumes of water gas. The gross calorific power calculated from the components would be—

For the coal gas, 5115 × 0·517 = 2644 calories.
,, water gas, 2650 × 0·483 = 1280 ,,
,, benzol, 10 × 32 = 320 ,,

Gross calorific power (calculated) = 4244 calories per cubic metre (= 476½ B.T.U. per cubic foot).

But Junkers' calorimeter showed that the calorific power of the mixed gas was actually 4770 calories. Consequently, the gain secured by self-carburetting amounted to 4770—4244 = 526 calories per cubic metre, or 59 B.T.U. per cubic foot.

It follows from a comparison of these data with those for the 50 per cent. addition of water gas, that the gain secured by self-carburetting increases with the proportion of water gas added. This was to be anticipated from theoretical considerations, and, indeed, exact analytical investigation showed that it was attributable to a gain in marsh gas and heavy hydrocarbons. If, in the next place, normal coal gas having a gross calorific power of about 5600 calories per cubic metre (629 B.T.U. per cubic foot) is assumed to have been used in place of that of only 5115 calories, the 0·517 cubic metre of coal gas would yield 2894 calories, and this, added to the 1280 and 320 calories from the water gas and benzol, gives a calculated calorific power for the mixed gas of 4494 calories, and adding the gain of 526 calories found in the previous calculation to be due to self-carburetting, the gross heating value of the mixed gas would actually be 5020 calories per cubic metre, or 564 B.T.U. per cubic foot. This is what might be expected to be the calorific power of mixed gas made by passing into the retorts water gas in volume approximately equal to that of the coal gas produced, and assuming that the coal gas is of normal calorific power.

The trials have shown that it is not objectionable, but, on the other hand, is even very advantageous, when the Welsbach mantle is used, to produce a coal gas diluted to the highest possible degree with water gas. The times are no more when it was necessary to produce from coal the most highly illuminating gas for flat-flame and argand burners. The Welsbach mantle does not require gas of high calorific power, but rather one affording a high flame temperature, on which factor the luminosity of the Welsbach mantle is known to depend. The flame temperature, however, rises as more water gas is added to the coal gas. It may be very plainly demonstrated by the following calculation that actually the illuminating power of the Welsbach mantle does not depend on high calorific power of the gas. Using coal gas having a net calorific power of 5000 calories per cubic metre (562 B.T.U. per cubic foot), the Welsbach burner gives a light of 80 Hefners (70 candles) for a consumption of 110 litres (3·88 cubic feet) per hour; while using water gas, having a net calorific power of 2500 calories per cubic metre (281 B.T.U. per cubic foot), the same light is obtainable for a consumption of 130 litres (4·59 cubic feet) per hour. Consequently, the heating value of the gas consumed per Hefner is—

$$\frac{110 \times 5{\cdot}000}{80} = \text{about 7 calories for coal gas}$$

and

$$\frac{130 \times 2{\cdot}500}{80} = \text{about 4 calories for water gas.}$$

The corresponding figures per English standard candle are—

31·1 B.T.U. for coal gas,
and 18·4 B.T.U. for water gas.

It thus appears that gas of higher flame temperature, though having only half the calorific power of coal gas, is capable of yielding nearly the same illuminating value with the Welsbach mantle. In the trials with an addition of 100 per cent. of water gas, however, there was added, on the average, 20 oz. of benzol per 1000 cubic feet of mixed gas, because it was still necessary in Güstrow to take into consideration a few flat flames, to satisfy the practical requirements of which an illuminating power of 8 to 10 Hefners (6·6 to 8·3 candles per 5 cubic feet) was maintained. Still greater advantages would, however, naturally accrue if it were feasible to dispense with the supply of illuminating gas, and, consequently, to cease adding any benzol. The lighting value of such unbenzolized gas in the Welsbach burner is practically the same. Moreover, when consumed in the argand burner, at the rate of 150 litres per hour, it would still afford a light of 2 to 3 Hefners—say, 1·6 to 2·5 candles per 5 cubic feet.

The foregoing arguments suggest the idea of gasifying coal on gas-works in such a way that only enough coal gas is produced to furnish the coke required for the production of mixed gas, when the whole of the saleable coke is converted into water gas and the latter is added by the self-carburetting process to the coal gas. Assuming that, after providing for heating the settings,

coke equal to 50 per cent. of the coal carbonized remains for sale, and, further, allowing 10 per cent. more for sundry heating purposes, &c., there will be available for the production of water gas very nearly 900 lbs. of coke per ton of coal carbonized. Then, if 25 cubic feet of water gas are made per pound of coke, the water gas obtained from the available coke amounts to nearly 22,500 cubic feet. On mixing with this the 10,400 cubic feet of coal gas obtainable from a ton of coal, there results about 32,900 cubic feet of mixed gas. Adopting self-carburetting, and assuming net calorific powers of 5000 calories per cubic metre (562 B.T.U. per cubic foot) for the coal gas, and 2500 calories (281 B.T.U) for the water gas, and a gain of 526 calories per cubic metre (59 B.T.U. per cubic foot) of mixed gas due to self-carburetting, the calorific power of the mixed gas would be about 3826 calories (net), or 4300 calories (gross) per cubic metre (429 or 483 B.T.U. per cubic foot). This mixed gas would consist of 214 volumes of water gas to every 100 volumes of coal gas. These larger additions of water gas must be attended by industrial advantages of such great general importance that the author cannot refrain from at least indicating them.*

The annual production of coal gas in Germany amounts to about 35,000 million cubic feet, of which about 70 per cent. is consumed for lighting, and 30 per cent. for heating purposes. According to Dr. Bunte,† coal gas and mixed gas have practically the same lighting value when consumed in the Welsbach burner; but for heating and power purposes, an increased consumption in the inverse ratio of the heating values of the two gases would have to be allowed. Thus nearly four volumes of mixed gas would be consumed for heating, &c., in place of three volumes of coal gas, and therefore the total equivalent make of mixed gas for Germany would have to be 10 per cent. more than the present make of coal gas. But the coal required for producing this mixed gas would amount to only 35 per cent. of that now used in the manufacture of coal gas—that is to say, nearly two-thirds of the present consumption of coal for gas making would be saved.

It is evident that this diminished consumption would be a great advantage in the event of strikes, &c., as a given store of coal would last three times as long as at present, if the whole of the available coke were converted into water gas. But while such a drastic change in gas supply can hardly be rapidly accomplished, yet something can readily be done on existing gas-works towards preventing needless prodigality in the consumption of coal for gas making. For instance, the Güstrow trials have demonstrated that one-half of the saleable coke can in actual practice be employed to make water gas for self-carburetting. Moreover, taking into account the very low calorific power of the coal gas made there, it can be computed that a mixed gas having a net calorific power of at least 4000 calories per cubic metre (449 B.T.U. per cubic foot) can be produced when as much as 135 per cent. of water gas is added to the coal gas, and half the saleable coke is consumed in its manufacture.

In this computation, it is assumed that a ton of coal yields about 10,400 cubic feet of coal gas, and leaves half-a-ton of coke available for sale; that a Dellwik-Fleischer generator consumes 31·2 lbs. of coke in making 1000 cubic feet of water gas; and that a further 8¾ lbs. of coke are required for making steam. In all, nearly 40 lbs. of coke is consumed per 1000 cubic feet of gas made; and consequently one-half of the available coke (5 cwt.) will yield about 14,000 cubic feet of water gas. Then, allowing for the gain in calorific power due to self-carburetting, the 24,400 cubic feet of mixed gas obtained would have a net calorific value of 4090 calories per cubic metre, or 459 B.T.U. per cubic foot. On the basis of an annual output of about 210 million cubic feet of such mixed gas, works should be equipped for a maximum day's make of 450,000 cubic feet of coal gas, and 600,000 cubic feet of water gas, or a total of about 1,050.000 cubic feet of the mixed gas. Allowing a reserve of retorts of 20 per cent., there would be required for the coal gas manufacture (say) five settings of nine inclined retorts; and allowing one water-gas generator in reserve, the necessary water-gas installation would comprise one generator capable of making 17,500 cubic feet of water gas per hour, and two of half that productive capacity apiece.

Assuming that coal costs about 13s. per ton, that coke realizes 15s., tar £1 3s., and sulphate of ammonia £10 15s., and that the wages per 12 hour shift per head are from 3s. to 4s., the author reckons that the mixed gas would cost in the holder nearly 6d. per 1000 cubic feet, exclusive of depreciation and interest charges. The cost of coal gas on the same basis he puts at about 1s. 0½d. But as the coal gas has a net calorific power of 5000 calories per cubic metre (562 B.T.U. per cubic foot), whereas the mixed gas is only 4000 calories (or 449 B.T.U.), the cost per 1000 calories is 0·089d. with coal gas, and 0·053d. with the mixed gas. That is to say, the same number of units of heat in the gas cost about 40 per cent. less with the mixed gas than with coal gas. Similarly the costs of 1000 candle-hours, using the Welsbach burner, may be compared for the two gases. A mixed gas of the composition under consideration afforded a light of nearly 75 candles when consumed at the rate of 4·24 cubic feet per hour. This was approximately the same illuminating duty as coal gas affords in the Welsbach burner. Allowing an average light of 52½ candles over 1000 burning-hours, and a consumption of three mantles, costing 2½d. each, per annum, the cost of 1000 candle-hours works out at 1·06d. with coal gas, and at 0·62d. with the mixed gas. Thus the mixed gas is about 42 per cent. cheaper than coal gas for lighting by means of the Welsbach burner.

It was proved in the towns where the process has been tried that additions of water gas up to 50 per cent. entailed no alteration being made to Welsbach burners or heating apparatus. With higher proportions of water gas, however, it would be advisable to fit a ring over the air inlets of the bunsen burners in such a manner that the air inflow could be reduced by turning the ring. This ring could be supplied wholesale for about ¼d. It has already been fitted in Ludwigshafen, where a higher proportion of water gas than 50 per cent. is about to be added. For very much larger additions of water gas, it would be advisable to modify the present form of Welsbach burner, and to reduce the dimensions of the mantles.

The following figures show the author's estimate of the relative cost of the mixed gas containing different proportions of water gas, and of coal gas. Coal is charged at about 15s. per ton, wages and repairs are included, and the value of bye-products is allowed for; but interest charges, &c., are not taken into account:—

Composition of the Gas.	Proportion of the Saleable Coke Used.	Cost of 1000 Cubic Feet.
		d.
Coal gas	..	7·56
Mixed gas (A) ⅔ coal gas, ⅓ water gas.	about ⅓	6·22
Mixed gas (B) ½ coal gas, ½ water gas.	,, ½	5·54
Mixed gas (C) 32 p.c. ,, 68 p.c. ,,	whole	3·40

These estimates assume that the water gas is added by the self-carburetting process.

The author next quotes a letter from Herr Borchardt, the Manager of the Remscheid Gas-Works, giving the cost of coal gas there at 12·57d., and that of the water gas at 9·18d. per 1000 cubic feet. The gas at Remscheid has to be maintained up to 13½ to 14 Hefners illuminating power (11·2 to 11·6 candles); whereas at Güstrow and Ludwigshafen, a 10 Hefner (8·3-candle power) gas suffices. Reducing the proportion of benzol used accordingly, it would be found that the water gas (benzolized) required for making 10 Hefner (8·3-candle power) mixed gas would cost at Remscheid 7·6d. instead of 9·18d. per 1000 cubic feet as at present, and the mixed gas of 10 Hefner power would cost 10·9d. But Herr Borchardt's figures show that, even with the 14 Hefner power gas, the mixed gas is cheaper than coal gas by about 1·15d. per 1000 cubic feet.

The author concludes by quoting a letter from Herr G. Wahl, the Manager of the Güstrow Gas-Works, which corroborates the figures already given in regard to the mixed gas supplied from the works.

JUNIOR INSTITUTION OF ENGINEERS.

Visit to the New River Company's Works at Staines.

On Thursday, the 28th ult., the members of the Institution paid a visit to the Staines reservoirs communication works of the New River Company, by permission and under the personal guidance of the Engineer (Mr. Joseph Francis, M.Inst.C.E.). Special arrangements for their reception had been kindly made by the Contractors (Sir John Aird and Sons); Mr. Basil P. Ellis, who has been connected with the firm for many years, being present.

The intake is formed at the side of the Staines reservoirs aqueduct, and is furnished with an automatic measuring gauge. Thence the water will flow into a suction-tank, having a capacity of a million gallons, from which it will be pumped to a height of 24 feet into two subsiding reservoirs having a joint capacity of 300 million gallons and a total area of 62 acres, the depth of water in each being 20 feet. The embankment of the reservoirs will be of earth, with clay puddle walls in the middle, carried down to the London clay which underlies the site. From the reservoirs the water will flow through lines of 42-inch pipe to the filter-beds, first passing through tanks provided with float-valves in order to retain the surface of water in the beds at a fixed level. From the railway adjoining the works, a siding will be formed for the conveyance of coals, sand, castings, and other material required. Notable features of the inspection included the colossal engine-house; the processes in the formation of the puddle walls for the reservoirs; the ingenious gravel-washing apparatus; the puddle-clay excavation by means of the steam navvy; the puddle-mixing machine; and the locomotives, waggons, &c., on the Contractors' railway, of which there are ten miles laid. Mr. Samuel Cutler, jun., M.Inst.Mech.E., the newly-elected Vice-Chairman of the Institution, proposed that the thanks of the members for the opportunity they had had of viewing works of such magnitude and importance should be accorded to the Company's Engineer and to the Contractors. The proposition was heartily adopted—Mr. Francis and Mr. Ellis responding.

* From this point, Herr Dicke's treatment of his subject becomes more purely speculative, and the remainder of his original communication has therefore been more freely rendered into English and is considerably curtailed. Ed. J.G.L.].

† See "Journal," Vol. LXXVI., p. 1332.

ASSOCIATION OF GAS AND WATER ENGINEERS OF AUSTRIA-HUNGARY.

Annual General Meeting.

The Twenty-second Annual Meeting of the Austro-Hungarian Association of Gas and Water Engineers was held at the Casino, Olmütz, from the 21st to the 24th ult. At the opening of the meeting, Herr Mzik welcomed the Association on behalf of the Casino and Town Authorities, and the Honorary President, Herr Hubert Nachtsheim, returned thanks. A congratulatory telegram was received from Herr Wobbe, the Manager of the Municipal Gas-Works in Vienna, who was detained in Italy. The more serious business of the meeting was begun on Friday, the 22nd ult., at 9 a.m., under the chairmanship of Herr Nachtsheim, as an accident had prevented Professor F. Walter, of Vienna, the Vice-President of the Association, from presiding. The annual report was read, and Professor Walter and Herr Chr. Bolz, of Buda-Pesth, were unanimously elected to the posts of President and Vice-President respectively. Cracow was selected, after some discussion, as the place for the meeting in 1904. The Committee were elected, the accounts were passed, and a hearty vote of thanks was accorded to Herr W. Kefer, the Treasurer of the Association. The reading of the papers was proceeded with, and translations of the more important of these will be given shortly in the "JOURNAL." On the second day, a proposal for the alteration of the gas regulations of the year 1875 was discussed and decided upon with general approval. After further papers had been read and discussed, the Chairman brought the meeting to a close with a word of thanks to the authors of communications, and the authorities of Olmütz. On the afternoons of the 21st and 22nd, visits were paid, among other places, to the town water-pumping station at Chwalkowitz, the gas-works, and an exhibition of gas appliances then open in the town.

A DANGER OF SULPHATE SATURATORS.

The last number of the "Journal of the Society of Chemical Industry" contains the paper read by Mr. F. J. R. Carulla at a meeting of the Nottingham Section of the Society at Leicester (see *ante*, p. 357), in which he called attention to what he described as a "hidden source of danger" in sulphate of ammonia saturators. To make the matter plain to his audience, he first of all described the ordinary form of lead saturator, as shown in the accompanying diagram (fig. 1), and explained that the gases contained in it are led away as fast as they are made by the pipe B, usually placed vertically, but shown horizontal for the sake of clearness.

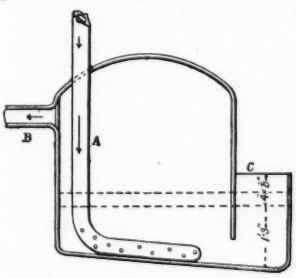


FIG. 1.

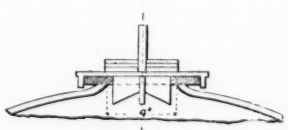


FIG. 2.

The ammonia-laden steam from the still rushes through the pipe A into the saturator, and issuing through the small holes in the foot of the pipe, meets with sulphuric acid in the bath, when the ammonia should be completely absorbed; the gases evolved (mainly sulphuretted hydrogen and carbon dioxide) passing forward through B. The sulphate collects in the bath, and is fished out at intervals through the opening at C. Variations in the level of the acid liquor in the bath are of regular occurrence, and can be observed in the fishing-well C. Assuming the level to be 1 ft. 9 in. from the bottom of the well, the liquid rises as the salting proceeds, and is at its highest level some 4 inches higher when ready for a "fishing" operation.

Mr. Carulla went on to say that under every conceivable occasional difficulty and disarrangement of a Davis column still, during a period of nearly thirteen years, the liquor in the saturator had always behaved in the manner described until a short time ago, when it came out of the well with such violent suddenness as to almost amount to explosion. Such an occurrence was not to be ignored, and it was desirable to prevent its repetition, as a very serious accident might have resulted had anyone been close to the apparatus.

The first investigations did not lead to anything that could give a clue to the cause of this overflow. All the outlet-pipes leading from B were found clear and open, but probably excessive pressure of the gases within the saturator was the immediate cause of the phenomenon, however the pressure might have originated. It was only necessary for this to rise to 0·3 lb. per square inch for the liquor to reach the brim; and anything above this would make it overflow. The employment of a safety-valve was the obvious remedy, and one (constructed as shown in fig. 2) was placed on the saturator. This temporary valve was made from a circular piece of thin lead having a rim burnt all round it to keep in a rubber washer, which formed a tight joint with the edge of a 4-inch diameter opening made in the crown of the saturator. Three wings were easily burnt on to the under side of the leaden disc to keep the valve in place; and a spindle in the centre was a convenient means for holding a number of thin discs of small diameter to obtain the necessary weight. It will be seen that as a 4-inch diameter area is 12·56 square inches, the weight of the valve had to be 3·77 lbs. in order to counterbalance a pressure of 0·3 lb. in the saturator chamber.

Further investigation revealed the fact that the feed of gas liquor to the still previous to the accident had been increased to an unusual extent, and the liquor at the same time happened to be stronger than usual. There could now be no doubt that excessive pressure in the saturator, caused by too large a feed, was the true explanation; but there seemed to be some difficulty in wholly reconciling the observations of the attendant with this cause. Mr. E. M. Fletcher, the District Inspector under the Alkali Acts, considered that when the gas pressure within the saturator chamber had so depressed the level of the liquor in the bath as to lay bare any of the holes in the foot of pipe A, the pressure of the unabsorbed ammonia and steam would be so great as to violently force out the liquor from the bath through the fishing-well in the manner that had been observed. A safety-valve is a real protection to a saturator, and none should be allowed to work without one, if immunity from this unlikely, but possible, accident is desired.

THE PODMORE AND THOMAS PATENT RECUPERATIVE LAMP FOR INTERIOR SERVICE.

It is not surprising that the success that has attended their application of the principle of recuperation to incandescent street-lamps should have led the patentees, Messrs. Podmore and Thomas, to turn their attention to its adaptation to lamps for interior lighting on the large scale—such as shops and other extensive interiors. As is well known, the invention is part and parcel of the lamp itself; and what is achieved by it is the heating of both the gas and air supply to an extent that, by means of the special burner used, and with ordinary pressures of gas, and the usual type of incandescent mantle, a maximum illuminating duty is obtained (according to Mr. T. Holgate) of 49 candles per cubic foot of gas consumed; or, according to the patentees, a minimum duty, allowing for depreciation, of 40 candles per cubic foot. A low gas consumption and a high illuminating power is the reputation sought to be established for these lamps. The street-lamps have been described on previous occasions; and what has been accomplished with them has (as we have seen at the show-room of Messrs. A. E. Podmore and Co., of Hatton Garden) been similarly secured in the new types of lamps which have been designed for shop and such-like illumination.

These new interior lamps are made with a single light or in clusters. The single-light type is at present produced in two sizes; and the clusters can be constructed of two, three, or any reasonable number of burners. To enable the reader to better understand the description, it will be an advantage to explain the lamps by the aid of the two illustrations on the next page. In fig. 1 will be seen the large single lamp, fitted with a special sized burner and mantle about 5½ inches long, of which some 5 inches come under the influence of the flame—giving, in the example seen, a uniform incandescent surface all round and to the top. At ordinary pressures, the consumption of gas is from 8 to 10 cubic feet; and the illuminating power can be readily calculated by multiplying the consumption by the makers' minimum claim of 40 candles per foot. There has been no change in the type of burner; and therefore all that need be done here—the form of the lamp being clear from the illustration (prepared from a photograph)—is to explain the method by which the air and gas are heated and supplied to the burner. About half way up the lamp will be noticed the circular reflector, surrounded by an ornamental border. Just above this reflector is a drum-shaped air-chamber, around the lower part of the circular body of which are a number of air-admission holes. Through this air-chamber runs the chimney for the products of combustion; and this chimney has an outer nickelled casing. The air entering the chamber circulates round the interior chimney, and thus becomes very highly heated. From here, the hot air passes by lateral connections into the tubes forming the outer frame of the lamp. Centrally, through the tube on which the cock is fixed is carried the gas-supply pipe; and the heated air passing down the annular space thus formed raises to a high degree the temperature of the gas. The hot air from both tubes and the gas from the single internal tube intermingle in the globular mixing chamber at the bottom of the burner. From this, it will be seen that no gas or air can (after the lamp has been lighted for two or three minutes) pass to the point of consumption without being highly heated—in fact, the burner and mantle are completely closed in; and this must make this type of lamp very advantageous in those places where dust and insects are troublesome and destructive to mantles. The lamps are supplied with a regulating screw governor, so that they can be readily adjusted to varying qualities of gas. The gas-cock can be

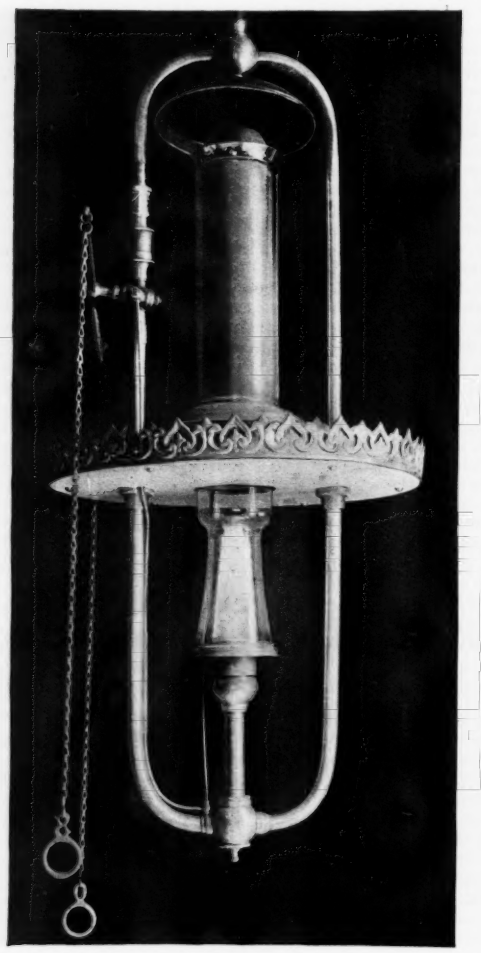


FIG. 1.—THE SINGLE-BURNER RECUPERATIVE LAMP FOR INTERIOR LIGHTING.

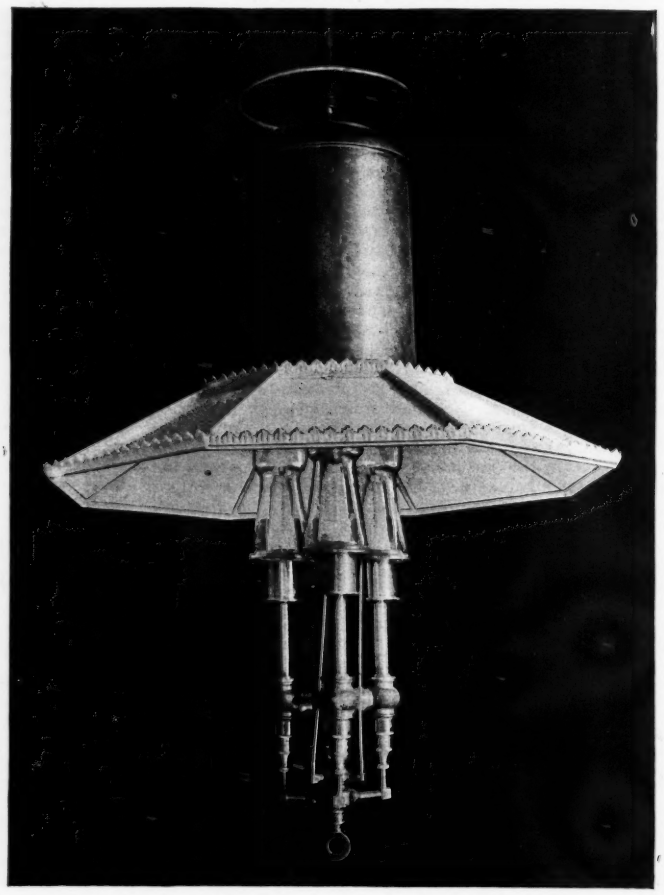


FIG. 2.—THE RECUPERATIVE CLUSTER LAMP FOR INTERIOR LIGHTING.

fixed in any suitable position—not necessarily on the frame. In the case of the one seen, it is about three parts of the way up the left-hand side tube, and is operated by a lever and chains. The glass surrounding the mantle is of the form adopted by the firm some time since—conical to the length of the mantle, and then expanding out again; the idea being that the gradual contraction concentrates and compresses the hot air in its upward passage on to the top of the mantle. The gas supply for the flash jet is taken from the side of the tap. (A lamp a size larger than the one described, and consuming from 10 to 12 cubic feet of gas an hour, is now being designed.)

The smaller type of the single lamp has a very natty appearance. It occupies much less space, and will be very serviceable for low-pitched shops. It is fitted with a 6-feet burner; but in this case it is not proposed to use a governor, as the lamp is furnished with an adjustable bye-pass tap—the supply being simply regulated by adjusting a screw. This lamp is constructed in its main parts similarly to the one already described; and with an opal crimp shade, it makes a very effective fitting. Its illuminating power is placed at about 240 candles.

After this description of the single-burner lamps, the construction of the cluster ones can be quickly explained. The double-burner type has a central hot-air supply tube; and the gas-tube is carried inside this. Above the circular reflector are two chimneys for the conveyance of the products of combustion; and these and the supply-tubes are enveloped in an enamelled iron casing (as shown in the illustration of the triple-cluster lamp). From the chamber thus formed, the heated air passes into the central tube at a point just above the reflector. Through this tube is a smaller one conveying the gas, which passes down to the extreme end of the main tube, and is led from there by short arms to the under side of the small mixing chambers below the burners (being controlled by a gas-tap at the foot of the central tube). The hot-air supply branches off a little higher up, and meets the inflow of gas in the mixing-chambers. In this case the consumption of gas is about 11 cubic feet; and the illuminating power is stated at between 400 and 500 candles. Fitted with a dome shade, the lamp has a very business-like appearance. The three-light cluster is constructed (see fig. 2) in a similar manner to the two-light one; and, in fact, the system can be extended to any reasonable number of burners in a cluster. Fitted with an octagon reflector, opal glazed, this triple-burner lamp looks well, and throws a very powerful downward light. The clusters are fitted with bye-pass taps; and with mantles of the size of the No. 4 Kern. The consumption of each burner is about 5¼ cubic feet. Multiplying the consumption by the number of burners, and the result by 40 candles per cubic foot, the total illuminating power attributed to the lights is found. By means of a ceiling rosette and horizontal shaft, these suspension lamps can be readily ventilated. With their production, Messrs. Podmore and Co. have not only considerably extended their scope for business, but they have added to the number of high-power lamps that the gas engineer has at command for the effective illumination of large interiors.

A SUB-AQUEOUS HIGH-PRESSURE GAS-MAIN.

An account of the laying of a high-pressure gas-main beneath the Mississippi River at New Orleans was given by Mr. Thomas D. Miller of that city, at the recent annual meeting of the Western Gas Association. The river has the reputation of being extremely fickle throughout its entire course; and though large sums of money have been spent in endeavouring to remedy this defect, it has only been possible to confine the channel through specific stretches. A decision having been come to by the New Orleans Lighting Company to supply Algiers (which is on the side of the river opposite to that on which the gas-works are situated) with gas, to be conveyed by a high-pressure main laid in the bed of the stream, several experienced engineers were consulted as to the points involved in the proposed work. But the majority of them regarded the scheme as impracticable. Various reasons were assigned for this opinion. First of all, there was the extreme depth of the river; next there was its constantly shifting bed; then there was the swift current in the main channel; and, finally, there were at the bottom the wrecks of craft of all kinds. However, the Company were not to be deterred, and the scheme was commenced.

Having located by soundings the exact point at which the pipe was to enter the water, the power to be used in pulling it across the river was considered. The use of locomotives was abandoned, owing to local conditions; and a large derrick boat, with modern machinery, was engaged. This boat had a capacity of

lifting, on a straight pull, 57 tons. The pipe and the protecting sleeves were all taken across the river to a spot near where the pipe was to enter the water. A ditch was dug at the point selected, at right angles to the water-line, and as this side of the river bed is very steep, no trouble was anticipated from the friction on the bank after the pipe was once started. Some 50 feet from the water's edge, the sounding showed a depth of 60 feet; while 250 feet out there was a depth of 120 feet. A length of pipe about 250 feet long was then put together, each joint being screwed up as tightly as possible. The joints were coated on the threads with asphaltum iron paint, for the double purpose of preservation and preventing leaks. Each coupling was enclosed in a split sleeve of cast steel, weighing 300 lbs., about 3 feet long, and held together by eight bolts. The first three sleeves were screwed as tightly as possible, and the remainder moderately tight, in order to allow some little play.

The shore end of the pipe was kept closed with a short length of pipe having a plug in it. The water end was also a short length with a solid coned end, about a foot long, having at its end an eye to which was shackled the hauling end of the cable. The cone was intended to cut through obstructions which would otherwise stop it. The pipe itself was made of the best 6-inch steel. The cable used in hauling it had a breaking strength of 120 tons.

The first attempt to take the cable across the river failed because of some carelessness in the winding of it on the reel. The second time it was wound, boards were put in lengthwise to the reel, so as to give a snug, neat coil, and also to keep the shackles from fouling. When the far end was made fast to the pipe-line, and everything was in readiness, a fall was hitched to the cable with chain-grips, and hauled taut, acting as a stopper, and the cable was unreeled to the next shackle, unshackled, and led into the drum of the hoisting-engine of the floating derrick, on the deck of which the work was being done. This derrick was securely tied up to the shore, and the reel strongly secured to the derrick.

A trench about 8 feet long was dug 250 feet from the shore line, and parallel with the water's edge; and two large pieces of timber were put into it. A second ditch was dug towards the river, and a short cable passed with a round turn around the timber, and the ends clamped with special cable-grips. A second short cable was hooked on to the first, and taken along the ditch to the water's edge, and a large snatch-block shackled to it. When all was ready, the cable was passed through the snatch-block as a fair lead to the drum of the windlass, and the signal made, "Ready to haul." This was answered from the other side, and the haul was begun. When the end of the pipe came near the water's edge, the signal was made, "Stop heaving." The plug end was then removed, and the next joints of the pipe were screwed on in succession, and the plug joint replaced for another haul.

The first hauls were easy, and, unless obstructions were met with, offered no difficulty; but the pulls became gradually heavier as the line entered the water. When the line of pipe was just outside the hull of the derrick, the cable was stopped and then slacked from the shore side and taken round under the barge. When all was ready again, and the cable gripped for hauling, the stopper was eased off, and the line of pipe hauled out of the river right through the mud of the bank, and about 15 feet from the water's edge, apparently in excellent condition. Some 15 feet of the line was hauled out of the New Orleans side of the river, and it slipped back when tension was removed from the cable. The work was considered successfully completed at this point.

The cable was taken across and attached to the pipe-line at 5 p.m. on Saturday, June 28, 1902. The first haul was made about 6 p.m.; and the end of the line came out on the New Orleans side at 10.15 a.m. on Monday, June 30—making the total working time of connecting up and pulling the pipe into the water about 32 hours. No work was done on the Saturday night after the first pull was made, but was resumed on Sunday morning at daylight, and continued straight through till the pipe was brought out of the water on Monday forenoon. There were 2100 feet of cable across the river; and the same quantity of pipe was used.

One of the conditions of the authority granted by the Port Commissioners for the work to be done was that the pipe on the New Orleans side should be placed 25 feet below low water at the dock line, and 30 feet on the keel, as this was the site of a proposed dock for ocean steamers. When the job was finally completed, the pipe was 10 feet below low water at the dock line, and about 15 feet on the keel; the Board having consented to let it go at this with the specific agreement that the pipe would be lowered when the Company were required to do so. The low-pressure line was partially down in Algiers, the governor station was completed, and gas was turned on in the district early last November, and consumers were being taken on rapidly. About ten days or a fortnight after the gas was on, the Engineers of the Commissioners gave notice to the Company that the contract was let for the construction of the new dock, and that the lowering of the pipe should be proceeded with at once.

A large sand dredge was secured to pump the earth from beneath the pipe, and thus permit it to settle. In order to keep gas on all the time, and yet have a flexible connection, a section of pipe above the water was removed, and the pipe extended up to the dock level, and connection made with 16 feet of heavy 2-inch boiler hose. This was accomplished in two hours. The dredge was started in shore, and gradually worked out towards the channel, the work being directed on the reports of a diver. This work was continued for three weeks; when the pipe had only settled about 4 feet. It was free, and could be swung backwards and forwards by hand; but it would not go down any farther.

Mr. Miller stated that the service in Algiers was entirely satisfactory. The Company have in use a combination regulator and governor. The pressure at the works is 30 lbs. on the square inch at 6 a.m., rises to nearly 40 lbs. at 3 p.m., drops to about 20 lbs. at 7 p.m., and remains practically steady till 5 a.m. On the high-pressure side of the Algiers governor, the pressure at 9 a.m. is 25 lbs. per square inch, at 3.30 p.m. it is nearly 30 lbs., it drops to 10 lbs. at 5 p.m., goes up to 25 lbs. between 6 p.m. and 7 p.m., comes down to 10 lbs. again between 7 p.m. and 8 p.m., and remains steady till 5 a.m., finishing at 30 lbs. at 8.30 a.m. On the other side of the governor, the pressure is very steady at about 28-10ths. Wet meters cannot be used in Algiers on account of the gas being so dry after compression that it literally drinks the water from a meter in a few days. Mr. Miller added that there had been no trouble from water getting into the main since pressure had been put on. When first laid, it served as a speaking-tube; and conversation was held through it.

REGISTER OF PATENTS.

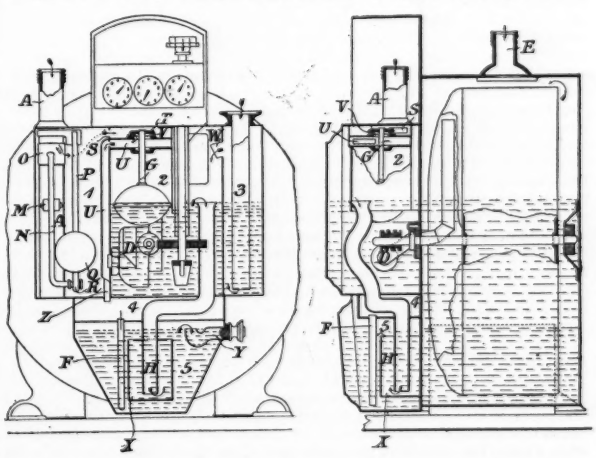
Ammonia Production by Synthesis.—Woltereck, H. C., of Victoria Street, S.W. No. 2461; Jan. 30, 1902.

The patentee claims to have discovered that, in order to form ammonia by passing nitrogen and hydrogen over a heated contact material, the contact material must be a metallic oxide, and that care must be taken, if the formation of ammonia is to continue, to prevent the oxide becoming completely reduced. According to his present invention, he passes air and a gas containing hydrogen (such as coal gas or water gas), preferably in about equal volumes, over an oxide (such as iron oxide) heated to a dull red heat. The gases may be mixed prior to their entering the reaction tube or chamber containing the iron oxide, or they may be separately introduced and allowed to mix in the chamber itself. They are charged (or, at any rate, one of them is) with moisture before entering the chamber, or preferably steam is introduced into the chamber. The oxide is disposed in such a manner as to offer the most intimate contact and largest surface to the reacting gases. Rolls of iron wire netting, thoroughly oxidized before being used, answer admirably, it is said; and balls of a mixture of kaolin or fire-clay with iron oxide have also been used with good results.

When coal gas is employed as the gas containing hydrogen, a quantity of amines is also produced, which may be decomposed in any of the well-known ways, with formation of ammonia either by passing the gases as they emerge from the reaction tube or chamber over heated lime or through boiling caustic solution; or such amines may be decomposed in the chamber itself, if lime be mixed with the iron oxide. The ammonia formed by the process may be fixed as a salt by absorption in the usual way; and the mixture of gases after the ammonia has been extracted still contains considerable quantities of hydrogen available for the production of ammonia.

Gas-Meters.—Alafalla, P. B., of Barcelona. No. 10,982; May 13, 1902.

From the front and side sections of the meter shown in the engraving, it will be seen that it is divided in two main portions—front and rear. The rear portion contains the drum which operates the recording mechanism, and forms no part of the present invention. The front portion is divided into five chambers. Chamber 1 is dry, and contains the gas-inlet valve. The gas is introduced by a pipe A having a nozzle



at the side. On the front of the pipe is a support M, in which is pivoted a rod N having at its upper end a face-piece O adapted to close the nozzle of the inlet-pipe. A rod P, hung from its upper end, has on it a weight Q, which engages with the bent lower end of the valve-rod N by a fork-shaped extension R. By this device, the opening is closed

whenever the meter is tilted forwards. A passage S leads from Chamber 1 into a box at the top of Chamber 2. In the latter chamber is a float-valve G, adapted to close by its head the opening from the box to the pipe U.

When the float valve is raised, the gas passing into Chamber 1 and through the opening S enters the pipe U through the opening V beneath the head, and, passing down the pipe, is conducted into the rear portion of the apparatus by a pipe D taken from Chamber 2 into the rear portion of the apparatus. After operating the drum in the rear part of the apparatus, the gas escapes through the outlet-pipe E.

The water is introduced into Chamber 3 by a pipe C. It overflows into Chamber 2 by the nozzle W, and is free to pass from Chamber 2 into the rear part of the apparatus, which contains the recording drum, owing to the provision of a large opening in the wall between Chamber 2 and the rear part of the meter. In Chamber 2 is also a pipe H, which serves as an overflow to keep the level of water in this chamber constant. The pipe passes downward into the pocket or receiver X. Y is an overflow of the usual kind communicating with Chamber 5, and closed by a screwed cap. A pipe F communicates between the bottom of Chamber 5 and Chamber 4. The gas-pipe U also has an extension Z beyond the entrance to the pipe D, and opening below in Chamber 4. By this means, any water which condenses in the pipe U is allowed to run into Chamber 4, and, moreover, the gas is allowed to act upon the water in Chamber 5 owing to the arrangement of the pipes Z and F, and thus to establish the requisite pressure upon the water in the chamber in the usual manner.

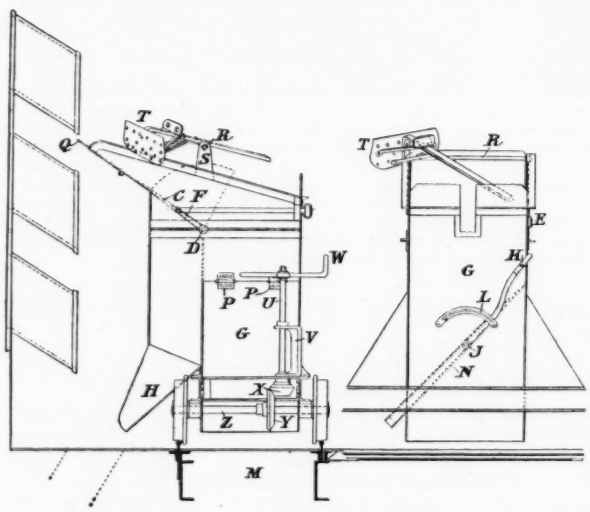
The action of the valve arrangement in Chamber 1 has been already explained. The float-valve G will always close the opening V should the water-level in Chamber 2 be allowed to fall—for instance, after the meter has been tilted forwards when water will have flowed away from Chamber 2 through the pipe H, thus lowering the level in the chamber.

Manufacturing Lighting and Heating Gas.—Johnson, J. Y.; a communication from the Deutsche Continental Gasgesellschaft and J. Bueb, of Dessau, Germany. No. 15,154; July 7, 1902.

The specification of this "vertical retort" patent is noticed elsewhere to-day, p. 667.

Discharging Inclined Gas-Retorts.—Herring, W. R., of Edinburgh. No. 12,746; June 4, 1902.

This invention has for its objects: Firstly, to facilitate the removal of the coal-stop from the mouthpiece of the retort and setting it in such



a position as to be ready for reinsertion as soon as the coke is withdrawn from the retort; secondly, to receive the coke immediately upon the removal of the mouthpiece-stop and direct it into (1) the coke-conveyor, (2) the basement floor, or (3) the producer charging door; and, thirdly, to provide a tar-screen for preventing the tar and coke dropping from the mouthpiece above upon the doors and levers of the mouthpiece immediately beneath. The apparatus to accomplish these purposes is preferably constructed separately for each horizontal row of retorts to be manipulated, though it may be combined in one.

In the arrangenent shown (for use in connection with the upper tier of retorts), a carriage mounted on wheels has formed on it a double shoot, in the upper part of which is fitted a hinged flap C, carried on a shaft D, and operated by means of a rod E and lever F, whereby the coke is directed at will either into the coke-conveyor trough at M immediately beneath the vertical part G of the shoot or (by reversing the position of the flap) into the inclined shoot H, which discharges through an opening in the floor communicating with the producer charging door. In the lower part of the vertical shoot G is fitted a hinged flap or tilting plate N, carried on a horizontal shaft J, and adjusted by means of the lever K and quadrant L, with a suitable lock-nut, and extending upward to a point above the shaft J. Thus, by inclining the plate N to either side, the coke may be discharged clear of the floor-plate into the conveyor-trough in either a forward or backward direction, as necessary. To permit this movement of the tilting plate N, the sides of the shoot G are provided with flap-doors, hinged at P.

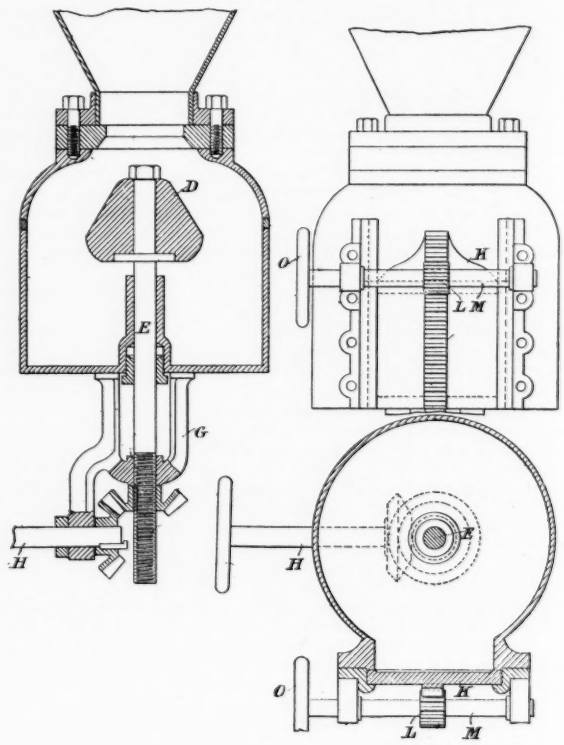
The tar-screen is formed by the projecting lip Q (fixed or adjustable), which catches and drains away any tar or liquid issuing from the mouthpiece of the retort on the door being opened.

The rail R, carried by brackets S above the body of the shoot, is provided for supporting the hand-tools used for opening the mouthpiece-door, and for supporting the coal-stop T after removal in such a position as to be ready for reinserting immediately the coke is drawn from the retorts.

Sulphate of Ammonia Saturator Discharger.—Ballantyne, J., of Hamilton. No. 27,070; Dec. 8, 1902.

This invention is designed for removing the salt in a comparatively dry state from time to time, as it is formed, from the saturator of a sulphate of ammonia plant.

As shown (in vertical section, end elevation, and horizontal section), the discharger consists of a vessel made of acid-resisting metal, attached

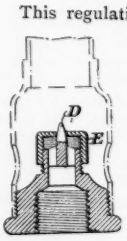


to the bottom of a saturator—the lower discharge hopper portion of which is alone indicated. At the junction of the vessel and hopper is fitted a plate having in it a central orifice suitably formed to constitute a seat for an upwardly-closing valve D, which is secured at the upper end of a spindle E extending through a stuffing-box in the bottom of the discharger, and terminating in a screw-threaded portion which passes through an internally screw-threaded eye in a hanger or depending bracket G, having an extension which serves as a bearing for a shaft H furnished with a hand-wheel. On the shaft is a bevel-pinion I, meshing with a bevel secured by a feather and groove on the end of the vertical spindle E, so that the latter may slide freely through the boss of the bevel. By turning the hand-wheel to operate the bevel-pinions, the spindle E is rotated, and carries with it the valve D to close or open the saturator.

On one side of the discharger is a doorway, over which is fitted a sliding valve or door K, having on its outer face a rack in gear with a pinion L on a shaft M carried in bearings on the outside of the vessel, and furnished with a hand-wheel O; the arrangement being such that, by turning the wheel, the sliding door may be raised to open the doorway for removing the sulphate collected in the discharger.

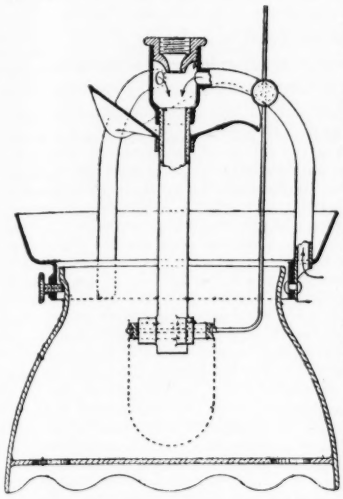
Regulating Incandescent Gas-Burners.—Bousfield, J. E.; a communication from S. Falk. No, 1425; Jan. 20, 1903.

This regulating nipple for incandescent gas-burners consists of a pin, which projects through the centre of a cap that can be screwed up or down through the air-holes of a bunsen burner without the necessity for removing the burner. D in the engraving is this pin, and E is the cap for regulating the quantity of gas passing through the nipple. The pin (which is provided with a conical head) is mounted in the centre aperture of the nipple through which the gas issues, and is provided with a series of radial ribs between which the gas passes. The cap is screwed on to the exterior of the nipple, and is provided with a central aperture through which the conical part of the pin projects. By turning the cap in one or the other direction, the area of the annular gas passage formed between the pin and the edges of the aperture can thus be varied as desired to regulate the quantity of gas passing



Inverted Incandescent Gas-Burners.—Ahrendt, H., of Berlin. No. 5977; March 14, 1903.

In the form of inverted burner shown in the drawing, the downwardly directed nozzle-pipe carries a mantle at its lower end in any suitable manner; while at its upper end (instead of the ordinary air inlet apertures) it carries three small downwardly directed air-tubes, which are so formed at their lower ends as to have a lug or projection on the inside to carry a ring, on which, by screws, a globe is fixed in the ordinary manner. As the waste gases escape outwards at the upper end of the bell or globe, only the pure and cool air is conveyed to the nozzle-tube in the direction indicated by the arrows. A diverting or baffle plate may also be employed at the upper end of the nozzle-tube, formed so as to divert the waste gases.



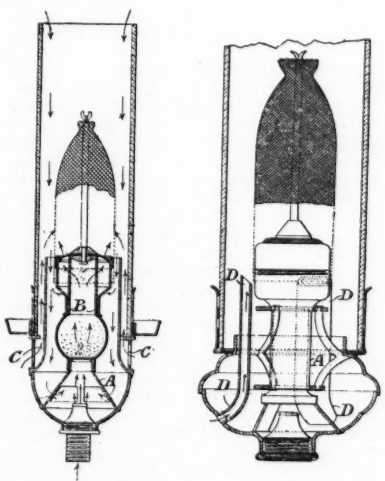
The lower part of the nozzle-tube is preferably made of a fire resistant material which is a bad conductor of heat — such as earthenware, porcelain, or the like. In this case, part of the tube may have at its lower end three or more radially projecting studs or lugs, which force the mantle holder to always retain a concentric position.

The mantle carrier is carried by a rod secured in a vertical slot in any suitable part of the burner—such as one of the tubes—and fixed by means of a pressure screw at any desired position as regards height.

In order to prevent particles of the mantle falling down, and to avoid any accidental disturbance of the mantle, the globe is constructed as shown—on its lower open side with a flat or domed cover plate of transparent material provided with air-inlet apertures.

Incandescent Gas-Burner with Preheating Arrangements.—Bachner, A., of Frankfort-on-Maine, Germany. No. 7514; March 31, 1903.

The present invention relates to incandescent gas-burners in which the mixture of gas and air is strongly heated before combustion; at the same time, a dissociation of the gases by the preheating is avoided, and any alteration of the constituents on their arrival at the burner avoided. The preheating device can be provided to all kinds of burners; the principle of operation being that in all cases the mixture shall be heated by the flame itself by a special arrangement of the inlets.

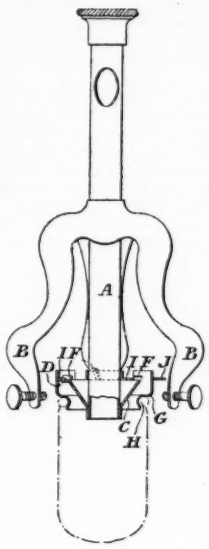


Over the gas-nipple is the casing surrounding the lower part of the burner, and carrying at its upper end the gallery, which in turn serves to support the chimney. In the first form of construction shown, there is a tube A covering the nipple provided with large apertures, and carrying at its upper end the mixing-tube B, which terminates with its perforated end in the burner-cap provided on top with an exit-orifice and mantle support. The gas passes to the nipple and mixes on its exit with preheated air coming through the chimney and the openings of the tube A, and then passes into the mixing-tube B, and from thence obliquely towards the openings in the burner-cap, and streams upwards and partially radially outwards, so that the mantle is always impinged upon. The air required for mixing with the gas is highly preheated (this is essential with all the forms of construction), by one part passing through the glass chimney into the casing, and from there through the openings in the tube A, and also through the holes provided in the lower surface of the burner-cap. A second stream of air flows up through the openings C, between the casing and the glass chimney, and passes (likewise highly preheated) through the casing to the flame.

In the second form of construction, the casing is closed on all sides, and through it pass tubes D, leading upwards, serving to conduct the air to the flame in such a manner that all the air (the air for combustion as well as the air for the mixture) which passes partly through the tubes is subjected to a powerful preheating, while the gas itself is heated in the tube A.

Inverted Incandescent Burners.—Falk, S., of Farringdon Road, E.C. No. 7864; April 4, 1903.

The inverted gas-tube has fixed at its lower end a gallery having a series of segmental projections with upturned ends; and in connection with this gallery is a ring (to which the mantle is adapted to be fixed) having a series of inwardly-turned lips adapted to lie upon the segments of the gallery, and a series of outwardly-turned lips for supporting the ring when detached from the burner.



A is the gas-tube, and B are arms for carrying a globe or shield around the mantle, both of which are of usual construction. C is the gallery attached to the lower end of the tube A; the gallery being in the form of an inverted cone provided with the segmental projections D, with the spaces E between them, the ends of the segmental projections being turned upwards at F. G is the mantle-ring, which is of a diameter slightly larger than that of the cone C and the projections D; the ring being at its lower part provided with a groove H for receiving a cord of incombustible material for binding the mantle on to the ring. I are the inwardly-turned lips upon the mantle-ring. They are formed by making longitudinal slits in the ring, and turning down pieces of the metal between the slits. J are the outwardly-turned lips, which are formed in a similar manner. The ring is applied to the burner by passing the lips I through the spaces E of the gallery, and then rotating the ring relatively with the gallery sufficiently to cause the lips I to lie upon the segments D; the upturned ends F of the segments preventing the ring G from being inadvertently detached from the gallery.

APPLICATIONS FOR LETTERS PATENT.

11,850.—Kerslake, W. E., and Turner, C. F., "New process in connection with carbide of calcium." May 25.

11,874.—Soehnlein, H., "Gas-engines." May 25.

11,967.—Allaway, H., "Nose-piece for gas-fittings." May 26.

12,001.—Lake, W. R., "Manufacture of fuel compounds." A communication from The Fuel and Gas Manufacturing Company. May 26.

12,018.—Howorth, F. W., "Automatic gas-igniting devices." A communication from P. Flachshaar and M. Baer. May 26.

12,068.—Shaw, L., "Gas-burners used for 'gassing' yarns." May 27.

12,090.—Cornwall, E., "Incandescent gas-burner." May 27.

12,114.—Schmalenberg, A., "Indicator suitable as a photometer." A communication from C. Ernst and Co. May 27.

12,127.—Singer, I., "Mantles for incandescent gas-lights." May 28.

12,182.—Horn, G., "Manufacture of water gas or mixed gas." May 28.

12,236.—Peaty, H., "Purification and washing of coal gas." May 29.

12,296.—Tavender, C., "Heat-distributor for gas-lamps." May 29.

A Loss at Leigh.—The annual report of Mr. J. Gibson, the Gas and Water Engineer to the Leigh Corporation, states that, though the gross profit on the operations of the gas-works during the past year amounts to over £9000, there is a net deficit of £1285. This is due to the large increase in the sinking fund and interest payments; the capital invested in the works being £159,000. The water-works show a profit of £522.

Stealing Electrical Energy.—The "Electrical World" of New York states that a Mexico City hotel keeper has been convicted by a local Judge for stealing current, and condemned to a year's imprisonment, with a fine of $33·70, and, as an additional penalty, "disqualified for all kinds of public honours and employments." This was the first case of the kind. The definition of the word "robbery" is elucidated thus in the district code: "He commits robbery who possesses himself of a movable thing belonging to another, without right and without the consent of the person entitled by law to dispose of it." The Judge's ruling was as follows: "By things or properties (for in legal phraseology these two words are synonymous) are understood all the objects that constitute the patrimony of man. If it is plain that electricity—whether it be called a fluid, a current, an energy, or any other name—at present forms a part of human wealth, and that, thanks to the prodigious progress of the times and to his own activity, man has succeeded in harnessing it and using it as a commercial article, it is unquestionable that the electric current forms part of man's commerce, and is, therefore, capable of being appropriated. As it is also unquestionable that this fluid can be transmitted and transported from one place to another, whatever the means employed to that end, it must also be regarded as a movable thing; and, therefore, there will assuredly be no difficulty in allowing that the clandestine tapping of the fluid constitutes the crime of robbery, as it fits exactly the terms of the legal text which comprises and defines it."

CORRESPONDENCE.

[We are not responsible for opinions expressed by Correspondents.]

Price of Gas for Power Purposes.

SIR,—No one will dispute your correspondent "H. B.'s" contention that if 10 per cent. of the gas at present sold were, for power purposes, reduced 3d. per 1000 cubic feet, the profits would be less, and either the dividends or the lighting consumer would suffer therefrom. The argument for low rates for power purposes is, however, based upon the anticipation that an additional consumption of an advantageous character would be thereby gained, and which could not be obtained at the ordinary lighting price.

Let "H. B.," instead of reducing the price of 10 per cent. of his present sale, assume that, by offering gas at special rates for power purposes, he will add 10 per cent. to his sales; and then, having regard to the favourable nature of the demand—in that it is a day demand, and an equal-all-the-year-round consumption—ascertain the lowest rate at which it could be supplied. He gives the net cost of his gas at 17d. per 1000 cubic feet, and the selling price at 2s. 6d. There is, therefore, a margin of 13d. per 1000 to work upon; and it is most improbable that a supply for power purposes would require 13d. adding to every 1000 feet for dividend and other charges.

The question may be looked at another way. Assuming that, of "H. B.'s" sale of 100 millions, 10 per cent. is at the present time sold for power purposes, and that the parties taking it resolved they would no longer do so unless they could have it at a 20 per cent. reduction on the lighting rate of 2s. 6d. per 1000. What course would his Board take? I think if they were well advised they would make the reduction, and keep the consumption, in preference to losing it.

HENRY TOBEY.

Malton, May 29, 1903.

Clips for Meter Unions.

SIR,—I have been interested in the question between Messrs. Green and Briddon, over the merits of their respective clips for protecting meter and service couplings.

The "JOURNAL" for March 17 is just to hand and illustrates Mr. Green's clip. I do not know how long Mr. Green has had his clip in operation; but to those interested, may I be allowed to state that I patented precisely the same clip now claimed by Messrs. Green and Briddon in 1894, No. 11,965. In my case, however, I neither used seal nor padlock, but devised a simple and effectual plan of screwing the two halves together by means of a screwed stud-pin, of peculiar construction—the pin going completely into a recess beyond reach of any ordinary tool, and yet easily dealt with by authorized persons possessing the necessary tool.

Though personally convinced of the desirability of such security, I seem to have been a little "too previous;" for I confess that none of my friends were impressed with the necessity of such apparatus. I feel, however, quite certain the experience of the Liverpool Gas Company is a fairly universal one where gas is sold, and that the development of the slot-meter system will force the "protectors" into use freely. I know of no commodity on sale so easily "on tap" as the gas supply. Under existing circumstances, the meter unions and service caps and linings adapt themselves very readily to many handy tools to be found in common use; and while the connections remain as they are in design, it seems only a common-sense plan to make them inaccessible to fraud.

G. J. COX,
Chief Meter Inspector
Metropolitan Gas Company, Melbourne.

April 28, 1903.

Bolton Corporation Gas Supply.—With regard to our notice of the past year's working of the Bolton Corporation Gas Department, Mr. William Smith, the Engineer and Manager, writes: "I find in the 'JOURNAL' of June 2, on p. 602, you give an account of the Bolton Corporation gas supply; and you state in the last paragraph that the works are under the supervision of Mr. A. E. Saville. This is not so. I am the Manager of the Bolton Gas-Works, and have been for the last seventeen years. Mr. Saville is one of my foremen. Please to have this matter corrected, and oblige."

The Rating of Reservoirs.—At the last meeting of the Havant Urban District Council, the Clerk read a letter from the Secretary of the Portsmouth Water Company claiming that they were entitled to a rebate of three-fourths of the rates levied on land which was covered by water. They therefore asked for this abatement with regard to their reservoirs. The Chairman (Mr. W. Fletcher) remarked that this was evidently something new, as up to the present time the Company had paid their rates without question. Major Stubbington expressed the opinion that the reservoirs were rather in the nature of buildings than land, and should therefore be fully assessed. The matter was referred to the Finance Committee.

Gas-Works Loan for Newbury.—The Newbury Town Council have decided to apply to the Local Government Board for leave to borrow £3000 for services, meters, fittings for prepayment meters, new public lamps, &c., which it is estimated will cover the expenditure in these respects during the next three years. It has also been resolved that £500 shall be transferred from the profits on the undertaking to the credit of the general district fund. Great satisfaction was expressed at the position of the gas-works. It transpired that last year 460 tons of coal less were used, while the make of gas was 4½ million cubic feet more. The leakage, too, has been reduced from 10 per cent., at which it stood a few years ago, to the moderate figure of 6½ per cent.

LEGAL INTELLIGENCE.

THE GAS-COMPRESSORS AT THE GLASGOW EXHIBITION.

Judgment in the Court of Session.

In the Court of Session, on the 19th ult., evidence was led before Lord Low in the action brought by the James Keith and Blackman Company, Limited, against the Incorporated Glasgow International Exhibition Association, 1901, in which decree is asked for £347 10s. 5d. After negotiations with regard to the supply of a compressor to be used in connection with the gas for the lighting of a portion of the Exhibition, the pursuers, on the 26th of January, 1902, wrote as follows to Mr. T. Young, the Engineer for the Exhibition: "We are willing to supply, free of charge, one of our largest machines, as shown during the currency of the Exhibition, on condition that we are allowed to make an exhibit of the said machine, and advertise it as being selected for the supply of the high-pressure gas for the lighting of the grounds of the Exhibition. The machine would be delivered free on rails at Arbroath station, after which the Exhibition authorities would bear the expense of carriage and the fitting up and connecting of the machine to the mains in the exhibition by our men and to our instructions." This letter was handed to Mr. W. Foulis, the Gas Engineer to the Glasgow Corporation, who replied to it, and suggested that there should be two compressors instead of one. It was decided that two machines should be provided, and the arrangement was carried through. The pursuers supplied a skilled attendant for 27 weeks to attend to the compressors in the Exhibition. The sum sued for was made up of £54 for the skilled attendant; £183 10s. 5d. for erecting, fitting, and installing the compressors, including the time of skilled workmen employed, travelling expenses and other out-of-pocket expenses; and £105 as the charge for Mr. Keith's professional and personal services and attendance. The defenders said that the Corporation took an active interest in the lighting of the Exhibition, and supplied the gas which was used free of charge, but that Mr. Foulis, their representative, did not make the arrangements for the machine. The Engineer to the Exhibition did so, and he engaged and paid skilled attendants to look after the compressors. The defenders were willing to pay the amount properly due from them under the agreement; but they maintained that the first and third charges were not proper ones against them; and as to the second, they said it was overcharged and they offered £80 as the amount strictly due. Subsequently, however, but before the proof, they increased the amount to £126 10s. The pursuers were represented by Mr. Aitken, K.C., and Mr. Orr; the defenders by Mr. Younger.

Mr. Keith was called to support his claim; and Mr. Foulis gave evidence on behalf of the defenders.

Lord Low reserved judgment, which he delivered last Friday. He said the pursuers' attention seemed to have been first drawn to the matter by an advertisement which was published by the Executive of the Exhibition, intimating that they would be prepared to receive proposals for exhibits of novel methods of gas lighting for illuminating the grounds and detached buildings. It was added that "for such exhibits gas would be supplied free of charge." The advertisement therefore was for "exhibits." The first item in the account was for the time of the men employed in erecting the machines, and amounted to £93 10s. This sum was to a large extent an estimate, as the pursuers did not, as they ought to have done, keep an exact record of the time occupied. He was satisfied, however, upon the evidence, that the estimate of the time upon which the charge was based was not excessive. But it was said that the rate charged was so. It was admitted that the amount was (assuming the time to be correct) more than was actually paid to the men. Thus, for an ordinary workman the charge was at the rate of 1s. 3d. an hour, whereas they were only paid 7½d. Mr. Keith justified the charge on the ground that there were certain oncost expenses to be taken into consideration, and that the practice was to meet these by adding from 25 to 30 per cent. to the wages actually paid. He did not think it was seriously disputed by the defenders' witnesses that this was the practice; but they said that 1s. an hour for an ordinary workman would have been a full charge. He was disposed to think that the pursuers should be liberally paid for the work of erecting and fitting up the compressors, because, through no fault of their own, they were put to great trouble and inconvenience in performing the work. He therefore did not see his way to reduce the amount. The pursuers further charged £22 10s. as country pay, which, he understood, was an extra payment to men in consideration of their being away from their homes. It was admitted, however, that the sum actually paid was 10s. a week, not 15s. as put down. He saw no reason why more should be charged than the sum actually paid. The £22 10s., therefore, had to be reduced to £15. There was then a charge of £10 5s. for railway fares. This sum was not vouched; but he saw no reason for supposing that it was excessive, and accordingly he should allow it. There was next a charge of £12 for special air-vessels and pipes and fittings to suit the requirements of the water and gas services. Of this sum, £3 represented the cost of special air-vessels and valves which Mr. Keith said he had to supply because the water pressure was so much greater than he had been led to expect—120 lbs. instead of 50 lbs. per square inch. In view of the letters which passed between the parties, he thought it was vain for the pursuers to contend that because the water pressure turned out to be 120 lbs. the defenders were bound to pay for fittings which would not otherwise have been chargeable against them. The remainder of the articles for which the £12 was put down appeared to consist of necessary fittings to the compressors which the pursuers fitted up. He was therefore of opinion that the charge of £12 should be disallowed. There was then a charge of £10 10s. for cases for the machines and for packing them at the works. He was of opinion that this was not a good charge against the defenders. The pursuers then claimed a sum of £4 10s., which was the amount they paid to a man for painting on a signboard at the compressor-house a long announce-

ment to the effect that the compressors were used for illuminating the grounds, and were made by the pursuers. As the signboard was painted without communicating with the Exhibition officials, and without protest, he therefore did not think that the pursuers could claim repayment of the amount from the defenders. The fact which was proved was simply that the Exhibition Committee erected the signboard, and left the pursuers to put their own advertisement thereon, which they did. Then there was in the account a charge of £35 for Mr. Keith's hotel expenses in Glasgow for a month, while supervising the erection of the compressors. He might at the same time deal with the claim which the pursuers subsequently made, for £105 as a fee for Mr. Keith's professional services during the erection of the compressors. Mr. Keith sought to justify these claims. He said he remained at the Exhibition during the whole time the compressors were being erected, at the special request of Mr. Foulis. Even if this were the case, it did not follow that the defenders would be bound to pay him a very large fee, or even his hotel expenses. But he could not hold it to be proved that Mr. Keith personally supervised the erection of the compressors at the request of Mr. Foulis, because the latter was not asked any question on the subject, and it was not referred to in the correspondence. If, then, the charges for Mr. Keith's services could be justified, it must be because they were part of the expenses of fitting up and connecting the machines mentioned in the letter of Jan. 26, 1901. It certainly would be very surprising to find that the fitting up of two gas-compressors (which seemed to be very simple machines) required the services of a highly skilled engineer, at a fee of 100 guineas. His impression was that, so far as the interests of the Exhibition were concerned, the continued supervision of Mr. Keith was not necessary. His son, who was an engineer, and apparently the inventor of the compressors, was also present during the erection of the machines, and his services were charged for; and he (Lord Low) saw no reason why the work should not have been left in his hands. The truth appeared to be that Mr. Keith anticipated great advantage to his Company from the compressors being used, and he wished to make sure, by supervising every step himself, that, in the interests of his Company, everything should be done in the best possible way. Indirectly, the Exhibition might have reaped a benefit by his services; but he (Lord Low) did not think they were under any obligation to pay the amounts claimed. The only other charge was one of £54, for the use of a skilled man in the employment of the pursuers for the purpose of attending to the compressors during the time of the Exhibition. But, as the pursuers stipulated that the compressors were to be treated as exhibits by them, and that they alone should have right to use the compressor-house, he thought the inference was that they attended to the compressors themselves. It was the pursuers who insisted upon their own servant being in charge of the compressors and the house containing them, because they regarded them as being their exhibits, and because they had other articles in the house which they did not wish anyone else to interfere with. He was therefore of opinion that the pursuers were not entitled to charge the defenders for these services. The result was that, in his opinion, the pursuers had a good claim against the defenders for (1) £93 10s., (2) £15, and (3) £10 5s., amounting in all to £118 15s. The other claims could not, in his opinion, be allowed. He gave decree for £118 15s.

The defenders' tender being greater in amount than the sum for which decree was given, while the pursuers, according to practice, received their expenses to the date of the tender, the defenders had their expenses as against the pursuers from that date.

Gas-Governors Not Fixtures.

At the Southwark County Court, a short time ago, his Honour Judge Addison, K.C., had before him a claim by Messrs. W. Tice and Co., Limited, of Union Street, Borough, against a licensed victualler named Wyatt, the keeper of the Greengate public-house, Bethnal Green Road, for £17 10s. for gas governors supplied. The plaintiffs' case (as reported in the "Ironmonger") was that they supplied and fixed five governors at the house; the then licensee to exercise the option of paying for their hire or purchasing them. The house was shortly afterwards sold by the mortgagees, and was purchased by the defendant, who contended that the governors were included in the gas-fittings, the whole of which he had bought and paid for. His Honour held that the governors were not part of the fixtures, and gave judgment for the plaintiffs for the amount claimed and costs.

Liability for Repair to a Service-Pipe.

At the Epsom County Court recently, a claim was made by the Leatherhead Water Company for £1 18s. 6d. against Mrs. Sears; being the cost of repairs to the service-pipe from the water-main to her cottages in Skinner's Lane, Ashtead. The pipe was broken; and it was contended for the defence that the fracture was caused by its not being laid deep enough to bear the strain of traction engines passing over the road. The Company stated that the pipe was laid at a depth of 2 ft. 6 in., in accordance with their rules. The Secretary (Mr. J. Young) said that of late sewers had been laid all over the district; and during this work the Company's pipes had been frequently damaged. In many cases, the sewerage contractors had asked the Company not to apply to the Local Authority, and had promised to pay for the injury they had caused. The service-pipes in the road, however, were at the risk of the consumer. For the defence, it was contended that there had been negligence in the laying of the main; otherwise, it would not have been broken by a steam-roller passing along the road. His Honour (Judge the Hon. Arthur Russell) said the pipe was laid in accordance with the regulations of the Company; and when these were drawn up, he presumed it was carefully considered what was a safe depth to lay the pipes. There had been no evidence of negligence on the part of the Company; and he therefore decided the case in their favour.

MISCELLANEOUS NEWS.

MALTA AND MEDITERRANEAN GAS COMPANY, LIMITED.

The Ordinary General Meeting of this Company was held last Thursday, at the London Offices, No. 60, Gracechurch Street, E.C.—Colonel JAMES LE GEYT DANIELL in the chair.

The SECRETARY (Mr. A. W. Cooper) read the notice calling the meeting; and the report and accounts were taken as read.

The CHAIRMAN said he thought the account of the operations of the Company for the year ending March 31 last would, on the whole, be considered satisfactory—exhibiting as it did a not inconsiderable reduction (£1194) in the cost of coal, which was due in great measure to the more favourable freights during the year. It was true that this advantage was counterbalanced, on the other side of the account, by the reduction both in the amount and the price of coke sold; but they had also an appreciable increase in the sale of gas (£2220). Notwithstanding, too, the increase shown in the profit and loss account under the head of maintenance (£1750), for which he might mention *en passant* Malta was responsible, and the depreciation of investments which appeared in the profit and loss account for the first time (£1525), and which the Directors considered should be carried to that account—the two items making together £3275 against the profits—they were still able to carry over to the general revenue account a balance of only £288 less than in the preceding year. The gas sold, as compared with the previous year, showed an increase of 12·72 per cent.; or, expressed in cubic feet, 106,392,000. Turning to the balance-sheet, it would be seen that the outlay stood at the same figure as in the preceding accounts. While on this point, he might remark that, as most of the shareholders were aware, the Sicilian stations were worked under concessions which, to use a lawyer's expression, were of a "wearing-out nature;" and, for this reason, it was necessary to maintain and strengthen the reserves whenever opportunity offered, so that the reserves and the figures under the head of outlay at all the stations should represent as nearly as might be the actual position of the Company from time to time. He was of opinion that it was better to keep reserves as reserves, because it was easier to add to than to reinstate a reserve after writing off. Otherwise, as a matter of account, it would be simple enough to apply the reserve in reduction of the outlay, though he questioned the prudence of doing this. He mentioned this, as the policy of writing off had not escaped the consideration of the Directors; and they might take an early opportunity of discussing it with the Auditors. The stocks at the stations stood at £10,795, which was an increase of £1055, compared with the previous year. Of course, stocks were always liable to fluctuation; but they were all good, sound assets. The sundry debtors showed an increase of some £1823 upon the item of last year; the total being £14,973. Of these at Malta, the gas and meter rental represented £4006; at Trapani, £7552; and at Marsala, £1765—making a total of £13,324. Regarding their various investments, these had hitherto been shown in the accounts at cost price; but the Directors thought the actual market value at the time of taking the balance would better show the position of the Company's affairs. They had therefore had them officially valued, with the result that the application of the pruning knife had cut £516 from the investments for reserve fund, and £1008 from the other investments, or together £1525, which had been charged to profit and loss account for the year. Though these stocks which came under the category of gilt-edged securities showed this depreciation at the time of the balancing of the accounts, it was not unreasonable to expect that they would recover themselves. Therefore, the Directors—when considering the policy involved in the suggestion offered them that they might sell the securities now and pay off an equal amount of debentures—remembered that this could have been better done, if possible, at the time of making the investments than when they were at the lowest market price. He said "if possible," because the Directors anticipated they would find some difficulty in inducing the holders of the debentures to part with them before they matured, because it was not so easy in these days to get an investment of the character of a debenture paying 4 per cent. Moreover, they could not lose sight of the probable appreciation of the stocks in which the money was invested. (The Chairman showed that in some of the investments appreciation had already taken place.) Reviewing the working at the several stations, he said that at Marsala, the concession would mature in four years, but it was renewable for a further ten or twenty years. There they had sold 9,665,000 cubic feet of gas; the make was 10,187 cubic feet per ton of coal carbonized; and the rental (which was slightly on the increase) was £2765. The gas and meter rental due was £1765. At one time—not long ago—the Municipality owed the Company a great deal more. They then had recourse to a loan, and paid the Company off. Borrowing seemed to be the habit of Municipalities in Italy. At Trapani, the concession had twelve years to run. The quantity of gas sold there was 13,770,000 cubic feet; 10,145 cubic feet was made per ton of coal carbonized; and the gas-rental was £4585. He mentioned last year that the gas and meter rental due was £6920. The Municipality now owed them £6232 under a debt for which the Company had a judgment summons against them *plus* £1558, the balance of the current debt—making together £7790. These Sicilian stations had received the unceasing attention of the Board; and it had not been unaccompanied, as might be supposed, by some anxiety. Though the Directors were always assured that the debts were good (and he must say the experience of the Company had hitherto borne that out), the financial position of the Municipality was the reverse of satisfactory. The Directors, during the consideration of this subject, found that they were most fortunately able to avail themselves of the services of Mr. A. F. Phillips, who was going South on other affairs, to visit these stations, and to discuss the situation with the Company's officials, as well as with the authorities on the spot, and the Company's legal adviser and others in Rome with whom he was personally acquainted. Most of the shareholders knew well the value of the experience that Mr. Phillips could place at the

company's disposal; and he (the Chairman) considered the Company were under a debt of gratitude to that gentleman for the time and energy he had devoted to, and the ability with which he had dealt with, the various questions (which were all more or less fraught with difficulty) that came before him. If the Municipality paid at the due date of their promise, the Directors might be prepared to forego some portion of the interest. Coming to Malta, everything there was going on most satisfactorily. The results obtained fully justified the appointment the Directors made, under their General Manager (Mr. Starkey) some two years ago, of Mr. Wilson who had charge of the works, and later on of Mr. Reid as District Superintendent. It was gratifying to be able to report that their General Manager spoke in the highest possible terms of the ability and zeal displayed by these two officers in their respective departments. During last year the sale of gas at Malta had risen to 82,948,000 cubic feet—an increase of 12,199,600 cubic feet, or 17·26 per cent. The average make of gas per ton of coal was 10,748 cubic feet. It was satisfactory to note that they had succeeded in the past year in exceeding by 10 per cent. the highest amount of gas ever made in one year in Malta, and that was in 1896 before the advent of the electric light, and when all the streets and barracks derived their light from the Company. Thus in six years, by the increase from other consumers, the Company had made up and exceeded the loss caused by the installation of the electric light for public purposes as a Government industry—perhaps it would be more correct to describe it as a Government speculation. During these six years, the cost to Malta for light must have been considerably more than formerly. Things were going on so satisfactorily at Malta that, to keep pace with the demand, the Directors had been obliged to consider and decide upon an extension of the plant, which, they trusted, would put them completely at their ease before the end of the year. The Chairman concluded by moving the adoption of the report and accounts.

Mr. Stephenson R. Clarke seconded the motion.

Mr. Fisher asked how it was the dividend was always the same. He had noticed that for some years there had been no variation. He criticized the practice of sending out proxies, and regarded the London expenses of £1311 per annum as being too great.

Mr. A. W. Oke was pleased the Directors were able to put before the shareholders such a satisfactory report. He remembered the time when the dividend was only 4 per cent.; and he for one was glad to find the increased dividend of 5 per cent. was maintained this year. One could fully understand how high-priced coal and other circumstances had precluded the Company from paying the 6 per cent. dividend that was, he believed, declared for a great number of years. The practice of sending out proxies was followed by many gas companies; and he pointed out its advantages.

The Chairman, in reply, stated that proxies had always been issued. In order to legally constitute a meeting, they were bound to have a representation, in person or by proxy, of ten shareholders, holding 1500 shares. As to the London expenses, the item was made up of Directors' fees, £500; Auditors' fees, £42; office salaries, £600; rent of London office, £105; and incidental expenses, £64. These, he was sure, could not be considered excessive.

The motion was unanimously carried.

On the proposition of the Chairman, seconded by Mr. Stephenson R. Clarke, dividends were declared at the rate of 7 per cent. per annum on the first preference shares, 7½ per cent. on the second preference shares, and 5 per cent. on the ordinary shares, less the interim payments.

Proposed by the Chairman, and seconded by Mr. A. M. Paddon, the retiring Director (Mr. Basil T. Makins) was unanimously re elected; as were also the Auditors (Mr. R. Hesketh Jones and Mr. Thomas Guyatt), on the motion of Mr. Oke, seconded by Mr. Westbrook.

In graceful terms, the Chairman moved, and Mr. Paddon seconded, a vote of thanks to Mr. A. F. Phillips for the eminent services he had rendered to the Company, as explained by the Chairman in his opening address.

The motion was heartily agreed to.

Mr. Phillips, in responding, said it had been to him a matter of great pleasure to be of any service to the Company. He knew full well the difficulties just now of dealing with Italian Municipalities; and, when they got into Sicily, the difficulties were intensified. He did not think the shareholders need have the slightest fear as to the recovery of the money owing to the Company. It would require a little patience; but the money was perfectly safe.

With the usual resolutions heartily thanking the Chairman and Directors, the Secretary, the General Manager, the officers, and the staffs at home and abroad, the proceedings terminated.

SOUTH AFRICAN LIGHTING ASSOCIATION, LIMITED.

The Fourteenth Annual Meeting of this Association was held at the London Offices on the 27th ult.—Mr. D. Ford Goddard, M.P., in the chair.

The Secretary (Mr. W. Cash) having read the notice convening the meeting,

The Chairman moved the adoption of the report and accounts, which were noticed in the "Journal" for the 26th ult (p. 532). He said the condition of the Company's affairs was thoroughly satisfactory, and the business in both Grahamstown and Port Elizabeth showed continued increase. For the second year in succession, the sales of gas at Port Elizabeth showed an increase over the preceding year of 18 per cent. The number of gas-stoves in use had increased, and the number of consumers had again advanced. Since the conclusion of the war, the prosperity of the town had in no way abated; but the difficulties of discharging coal were by no means at an end, and the cost due to demurrage and other charges still remained a serious factor. He was pleased to say the Directors had quite recently been able to arrange several charters on more satisfactory terms; but he might mention that coal had during the past year cost them more by £2187 than in 1901. In addition, they had suffered from labour troubles. The kaffir boys were continually asking for higher wages; and these they had been compelled to give. At Grahamstown they had also had an increase of over 18 per cent. in the sales of gas. This town suffered severely during the war; but they quite hoped that it would now rapidly advance. Additional land had been acquired at Port Elizabeth and water-gas plant ordered. The latter would, they believed, help them materially in the coal difficulty, They were also trying to arrange for enlarged coal facilities. No reduction had been made in the price of gas. In fact, they had contemplated an increase which the cost of coal would have justified; but the Directors were glad that this, through care and the reserve made in 1901 for demurrage, had been avoided.

Mr. A. L. Don seconded the resolution.

Mr. Corbet Woodall, speaking on behalf of his firm as Engineers to the Association, said that he personally was thankful the results were so good. The rates paid by the Government for kaffir labour had spoilt the labour market, and the difficulties of the Manager in this direction had been very considerable. The satisfactory nature of the growth of the business might be judged from the following figures for the last ten years. During this period the capital expended had increased 138 per cent.; but the sales of gas had increased by 305 per cent. In 1892, the average price of gas was 11s. 9d. per 1000 cubic feet, and in 1902 it was 8s. 4d.; while the charge per 1000 cubic feet for dividend had fallen from 3s. to 1s. 11d. The works had been well maintained—in fact, in 1902 £1000 more had been spent under this head than in the preceding year. He considered the accounts disclosed conditions which should, in his opinion, be eminently satisfactory to the proprietors.

The resolution was carried unanimously; and on the motion of the Chairman, seconded by Mr. Henry Woodall, a dividend of 6 per cent. (making 10 per cent. for the year) was declared.

An Extraordinary General Meeting was subsequently held, at which it was unanimously resolved to increase the authorized capital of the Company (by £25,000) to £100,000, and the borrowing powers from £20,000 to £30,000. The Chairman explained that the present capital powers were almost exhausted, while the growth of the towns was rapid. He said that there was no immediate intention of issuing the further capital.

GAS AND ELECTRICITY AT BELFAST.

In proposing the adoption of the minutes of the Gas and Electricity Committee at the meeting of the Council of the County Borough of Belfast last Tuesday, the Chairman (Mr. G. Andrews) said there were one or two important points to which he would like to draw attention. The first was the report on the output of gas for the year to March 31 last, which he thought was of a satisfactory character. In every department there was an increase, except in the hiring of heating stoves, and that was only a very small matter. The total output of gas had increased by 3·059 per cent. In nearly every other place in the three kingdoms during last winter, owing to the mildness of the season, the output was either stationary or showed a decrease; so that the demand for gas in Belfast was in a very healthy condition. As to the financial aspect of the question, the net profit from the sale and manufacture of gas and bye-products was £41,526. This did not include the amount paid over by the Electricity Department to the Gas Department on the loan of £32,500. There was about £6000 which, although it ought to have gone to the credit of the Gas Department, was taken by the general purposes or some other fund by resolution of the Corporation. It would have only increased the profits a little, but would not have increased the net profit balance at all. The profit balance was disposed of by paying interest on sinking fund amounting to about £19,000, which left the real net profit at £22,500, from which had to be deducted £15,000 paid in relief of the rates and £4361 for the interest on loans for the City Hall; leaving a final net profit of about £3000. The next important point was the resolution fixing the rates for electric current. This matter had been before the Council every month for the last three or four months. The Committee had given it their careful consideration from time to time; and so far as they could form an opinion, the rates now suggested would be giving the current at as cheap a rate as possible to the various classes of users, having always in view the first right the ratepayers had to be protected against loss. The resolution of the Committee referred to by Mr. Andrews was to the effect that the rates for electric current should be fixed as follows: For current used for domestic lighting, a flat rate of 4d. per unit; and for lighting current to other consumers, 6d. for initial hour demand, and 1¾d. per unit for subsequent hours. Churches to have the option of a flat rate of 5d. or ordinary lighting rates—viz., 6d. and 1¾d. Current for other purposes than lighting, at 2½d. per unit for initial hour, and 1d. per unit for subsequent hours. The revised charges to come into effect in the quarter commencing July 1. The minutes were adopted.

Incandescent Gas Lighting for Poplar.—At the meeting of the Poplar Borough Council on Thursday, the Electricity Committee presented the following report: "The Commercial Gas Company offer to convert the remaining gas-lamps in the borough to the incandescent system, with No. 4 Kern burners in the principal streets, and No. 3 burners in back streets, and to renew the mantles when necessary, provided the Council will continue to use the lamps when altered for periods of 18 and 15 months respectively. The charge would remain as at present—viz., £3 9s. per annum—during the periods named, at the expiration of which the charge for the higher-power lamps would be reduced to £2 18s., and that for the smaller lamps to £2 9s. per annum. The only requirement of the Company is the guarantee of the Council that the lamps will be used for the periods stated. In any case, it is improbable that these lamps would be converted for electricity during that time, and we think advantage should be taken of the improved light offered." The Committee recommended that the Company's offer be accepted; and this was agreed to.

COVENTRY CORPORATION GAS AND WATER SUPPLY.

The annual report of the Gas Committee of the Coventry Corporation was issued to members of the City Council on Thursday. It shows that the total revenue for the year was £97,407; the expenditure amounting to £82,434. This leaves a gross profit of £14,972, to which is added the amount carried forward (£459) and bank interest (£574); making a total of £16,006. Against this there are capital charges amounting to £11,852; leaving a final balance of £4153. Last year the Council, on the recommendation of the Committee, prescribed the maximum reserve fund for the time being at £8000. The amount in the fund at present is £7257 16s. 7d. In the opinion of the Committee, the limit should be raised to £10,000, and £2000 of the net profits added to the fund. This would leave £2000 to be carried to the district fund, and a small balance to be carried forward.

The total borrowing powers exercised since the acquistion of the undertaking amount, with nominal additions, to £308,992. Of this sum, £22,950 of 3 per cent. mortgages has been paid off and may be re-borrowed; being a balance of capital invested in the undertaking of £286,042, of which £31,340 has been repaid out of the sinking fund. The present liabilities, therefore, amount to £254,702, against which the Corporation have reserve and sinking funds amounting to £19,114; leaving a balance of liability of £235,588. The amounts expended during the year on capital account were as follows: Foleshill works, £1654; new mains and service-pipes, £1696; new ordinary meters, £158; and new prepayment meters, £1742—in all, £5250. The total capital expended since the acquisition of the undertaking, including the original purchase-money, amounts to £250,794. The balance of capital in hand is £35,248. The borrowing powers remaining to be exercised, including the sum of £22,950 mentioned above, amount to £193,763.

The Committee have considered the present prices charged for gas, and are of opinion that, having regard to the great increase in the consumption of many manufacturing firms since the scale of rebates was fixed, the scale might with advantage be extended so as to offer greater inducements to the largest class of consumers. The present scale allows a rebate of 1d. per 1000 cubic feet on quarterly accounts amounting to 300,000 cubic feet and not exceeding 400,000 cubic feet, and of 2d. on account of this quantity and upwards, but makes no further rebate, however large the consumption may be. The Committee are of opinion that a rebate of 3d. should be allowed on quarterly accounts exceeding a million cubic feet, of 4d. on those exceeding 2½ millions, and of 5d. on those above 4 millions.

The Water-Works and Fire Brigade Committee in their annual report state that the receipts from water-rents amounted in the past year to £13,614, compared with £12,865 in the year 1901-2. The figure is the highest in the history of the undertaking. The expenses show a drop of £2843. The principal decreases come under the headings of repairs (£2567) and coals (£268). The net profit amounts to £4902, against an estimate of £4901. The unappropriated cash balance on March 31 was £5453, and the profits for this year are estimated at £4263. The Committee recommend that £3000 of the balance in hand should be paid over to the borough fund, in aid of the rates.

DUNDEE CORPORATION GAS DEPARTMENT.

The Accounts for the Past Year.

The accounts of the Dundee Corporation Gas Department for the past financial year have been issued. They show a surplus of £682, whereas a year ago there was a deficit of £7700. The quantity of gas manufactured was 665,202,000 cubic feet, of which 7,033,800 cubic feet were consumed on the works, and 48,139,400 cubic feet were unaccounted for—together 55,173,200 cubic feet, or 7·23 per cent. There was sold 610,028,800 cubic feet. The revenue from the sale of gas amounted to £102,654, compared with £99,668 in the previous year; from the sale of coke, £6038, against £4781; and from chemical products, £12,727, compared with £9727. The total revenue from all sources was £122,061, against £114,343. The cost of coal was £40,818, compared with £49,156; and of manufacturing gas £71,996, against £72,612. There was a reduction of nearly £300 in carbonizing charges. Rates and taxes amounted to £7318, compared with £4481. On the expenditure side, there was a fresh item of £1392 for benzol. A new feature in the accounts is the allowances for depreciation which have been made. These are: On works, 2 per cent.; on offices, 1 per cent.; on mains and service-pipes, 1½ per cent.; on meters, 6 per cent.; on gas-stoves, 10 per cent.; and on coal-waggons, 7½ per cent.

The estimates for the current year include an expected revenue of £113,290, and an expenditure of £111,848; leaving a surplus of £1442. It is anticipated that 700 million cubic feet of gas will be manufactured, and 636,967,800 cubic feet sold, from which the revenue will be £91,830, after allowing for discounts and bad debts. This sum is based on the proposal to reduce the price of gas from 3s. 6d. to 3s. per 1000 cubic feet for lighting, and from 3s. 6d. to 2s. 9d. for power purposes. From residual products a sum of £19,727 is anticipated. On the other side, it is reckoned that the cost of manufacturing gas will be £68,995, which is about £3000 less than the cost last year. Coal is estimated to cost £40,593; benzol, £4000; carbonizing wages, £9025; purifying, £2443; repairs and furnishings, £4350; retorts and settings, £4050; and fuel, £1250. In the distribution department, the estimate is £6000, made up of £2750 for repair of meters and wages of inspectors and fitters, £1500 for repair of mains, and £1750 for repair of services.

In the course of the Committee's proceedings, ex-Provost Brownlee said he thought that if the reconstructed works had brought about the results promised from them, a larger reduction than 6d. should have been proposed; it should have been at least 9d. per 1000 cubic feet. Mr. G. Stevenson was of opinion that the ratepayers had a better bargain a few years ago with gas of 24-candle power at 3s. 2d. than they will have with gas of 20-candle power at 3s. The Committee unanimously adopted the accounts, and agreed to recommend the proposed reductions in the price of gas.

WEST BROMWICH CORPORATION GAS SUPPLY.

At the Meeting of the West Bromwich Town Council on Wednesday, the annual statement of accounts in connection with the Gas Department, noticed in the "JOURNAL" last week, was submitted. Mr. J. E. Wilson, the Chairman of the Committee, in moving its adoption, expressed his satisfaction at being able to report a profit of a little more than £4000. The past year was the first in which the Committee had suffered from the decreased charge for public lighting, which amounted to something like £1000; and they might fairly say that, but for the concession they had made to the Highway Committee, they would have had to report a profit of upwards of £5000. He had always opposed the resolution with regard to the reduction of the charges for public lighting, because he felt it was not fair to ask the Gas Committee to supply gas to even the Highway Committee at a loss. He was quite satisfied that every 1000 cubic feet of gas they were supplying at the present prices entailed a distinct loss to the gas undertaking. At the present time they had an application from the Committee for additional lamps. The cost of the extensions of the mains would be at least £60; and as each lamp was supplied at a loss, the Committee were placed in a very unfair position, and it was impossible for them to do their duty to the town. They had a capital account in connection with the gas undertaking which now stood at £228,000; and though they were thankful that a dividend of 4½ per cent. would be available, were they a private company, yet it could hardly be considered a reasonable dividend for a concern of such magnitude. Instead of devoting the profit of £4000 in relief of the rates, they intended to place it to the credit of the suspense account, which would reduce the amount to £17,768. With the competition from the Electricity Department, it was necessary for them to husband their resources. They must expect an outlay of £2000 in repairs and improvements next year; and he intimated that the Committee would take into consideration the question of making concessions to consumers of gas for motive power, and thus encourage the industries of the town. He expressed his appreciation of the services rendered during the past year by the Secretary (Mr. T. Hudson) and the Engineer (Mr. Harold E. Copp), who had given him every assistance. Mr. J. Lawley said he was annoyed that not a penny was to be given in relief of the rates, as he did not see why West Bromwich should be different from other towns in this respect. Mr. W. Lawley said, as the Council had manifested a desire to reduce their debt, he was afraid they would not help the rates for some time to come. The accounts were passed.

DUKINFIELD CORPORATION GAS DEPARTMENT.

Report of the Engineer and Secretary.

Mr. Harrison Veevers, the Engineer and Secretary of the Gas Department of the Dukinfield Corporation, has lately presented his report for the year ending the 31st of March. He states therein that the new beds of 64 retorts, heated by regenerative furnaces, were at work all through the year, and surpassed expectations; the gas made per ton of coal having been, on an average, 753 cubic feet more than in the preceding twelve months, or a total increased make of 6,261,000 cubic feet, with a corresponding reduction in the cost of wages and of wear and tear. Great advances were made in the use of slot meters and gas-cookers; and an overhaul of the mains brought down the leakage from 16·05 to 13·87 per cent. As the borough is well supplied with the above-named appliances, Mr. Veevers considers that it will be advisable to lessen the delivery of them for the present, except to new property. There are now 1091 slot meters fixed in Dukinfield, the annual consumption of gas by their aid being nearly 9 million cubic feet, or equal to 11½ per cent. on the entire consumption. The make of gas from the 8315 tons of coal carbonized was 90,290,000 cubic feet; and the total quantity accounted for was 77,763,900 cubic feet, apportioned as follows: Cottages (ordinary), 37,067,000 cubic feet; do. (prepayment), 8,949,950 cubic feet; mills, 25,252,602 cubic feet; public lamps, 5,135,915 cubic feet; used in works, offices, &c., 1,358,433 cubic feet. The total revenue for the year was £14,100; the expenditure, £10,988—leaving a balance of £3112. Adding to this cottage rents £34, there was a sum of £3146 available for meeting annuities, interest and sinking fund, and bank interest, amounting in all to £3374, leaving an adverse balance of £228. As there was a sum of £158 on the profit and loss account on the 31st of March, 1902, the loss was reduced to £70. The gross cost of gas production per 1000 cubic feet last year was 2s. 9·91d., compared with 3s. 1·26d. before; and the net cost, exclusive of capital charges, 1s. 11·99d., against 2s. 5·68d. These charges (less the cottage rents) came to 10·33d., compared with 9·22d.; bringing up the total cost to 2s. 10·32d., against 3s. 2·9d. The average price of gas last year being 2s. 9·6d., the loss is 0·72d., compared with 5·33d. in 1901-2.

Carlisle Water Scheme.—At a recent meeting of the citizens of Carlisle, Mr. Scott, the Chairman of the Geltsdale Water Committee of the Corporation, announced that a letter had been received from Messrs. James Mansergh and Sons accepting the engineership of the scheme for the supply of water to Carlisle by gravitation from Geltsdale, estimated to cost £250,000. He added that Messrs. Mansergh's terms were perfectly satisfactory to the Committee.

PROPOSED WATER-GAS PLANT FOR ROCHDALE.

The Gas and Electricity Committee of the Rochdale Corporation, in their report for the year ending March 31, state that, after paying interest and sinking fund charges, the working of the Gas Department during the twelve months resulted in a profit of £18,359. Of this amount, it has been decided to carry £3000 to the reserve fund, and to repay to that fund the £2500 withdrawn from it, and applied in aid of the rates last year—thus leaving the substantial sum of £12,859 to be applied to the relief of the rates for the current year, in addition to the cost of public lighting, which is estimated at £5500. The reduction in the price of coal has been the chief factor in producing this satisfactory result; but there has been a falling off in the revenue from coke of a little over £2000, and had it not been for the increased yield from tar products and sulphate of ammonia, the balance would have been considerably less. The net income from residuals was 7s. 10½d. per ton of coal carbonized, against 7s. 11½d. last year; and the net cost of coal, after deducting the income from residuals, was 4s. 11d. per ton, as compared with 6s. 9d. in 1902. The Committee refer to the reduction in the price of gas which has recently been approved of by the Council, and point out that this will involve a loss of income estimated at £7600. They hope, however, that it will have the effect of increasing the consumption, which, since the rise in price in 1900, has not shown as much expansion as could have been desired. The attention of the Committee has again been called to the condition of the old retort-house; and instructions have been given for the temporary repair of a portion of the main roof, pending a decision as to the reconstruction of the house. In this connection, the question as to the advisability of the installation of a water-gas plant is receiving consideration. The total number of meters now in use is 27,655.

BURY CORPORATION GAS SUPPLY.

The Gas Engineer of the Bury Corporation (Mr. H. Simmonds) has issued his report on the working of the gas undertaking in the past financial year, together with the estimates for the ensuing twelve months. The total quantity of gas made was 376,449,000 cubic feet, of which 182,000 cubic feet were produced from benzol. The gas sold for private consumption was 327,868,200 cubic feet, and for street lighting purposes 29,175,850 cubic feet; while on the works and for public clocks 8,267,800 cubic feet was used. This made a total of 365,311,850 cubic feet; leaving a loss through leakage, condensation, &c., of 11,137,150 cubic feet, or equal to 2·9 per cent. Taking the quantity of gas sold, the cost of manufacture, distribution, &c., came to 2s. 3½d. per 1000 cubic feet. Deducting the revenue from residuals, the net cost was 1s. 3d., which was brought up to 1s. 10½d. by the interest and sinking fund charges. As the income amounted to 2s. 2d. per 1000 cubic feet, the profit (£5640) worked out to 3¾d. The estimated net cost of gas in the ensuing year, with the interest, &c., is 1s. 11¾d. per 1000 cubic feet; the estimated revenue, 2s. 2½d., and the estimated profit (£4500), 2¾d. At the close of the financial year, there were in use 2270 public gas-lamps, 1851 stoves, 2700 grillers, and 1690 prepayment meters. Of ordinary meters, 684 were fixed during the year, as well as 142 gas-fires and 17 gas-boilers. The Gas Committee have decided that the sum of £2820, being one moiety of the profit, shall be carried to the general district rate, and the other placed to the credit of the consumers. No change is to be made in the price of gas; but the charge of 2d. per quarter for grillers will be discontinued, and they will be supplied and fixed free.

LANCASTER CORPORATION GAS SUPPLY.

The net profits of the Lancaster Gas Department for the past year amounted to £4805, as compared with £1675 for the previous year. Of this, £1500 has gone in aid of rates, leaving a balance of £3305 to be placed to the credit of the reserve fund. Compared with the preceding year, the receipts from sales of gas (private consumers and public lamps) showed an increase of £1257; while the receipts from residuals were also more by £156. There was a decrease in expenditure; the cost of coal being £1139 less. The sum of £2079 was expended out of the reserve fund during the year in extensions and alterations; the amount to the credit of this fund being £13,596. The Gas Manager (Mr. C. Armitage), in his annual report, states that the total receipts, including bank interest (less commission), were £31,827, and the expenditure £21,041; leaving a gross profit of £10,786. Nothing was added to capital account during the year; but the sum of £2262 expended on new mains, meters, &c., was charged direct to revenue account. The receipts from ordinary consumers (£17,188) showed an increase of £394; and those from prepayment meters (£3846) were £790 more. The apportionment of the average price received per 1000 cubic feet of gas sold was as follows: Net cost of gas, 1s. 2·13d.; new mains, services, meters, and prepayment stoves, 3·13d.; interest on stock and mortgages, less interest from bank, 5·14d.; redemption fund, 2·23d.; to borough fund, 2·08d.; reserve fund, 4·58d.; average price received, 2s. 7·29d. The coal carbonized cost 13s. 3·64d. per ton, as against 14s. 10·26d. in the preceding year. Coke contributed in return 5s. 1·07d., and tar and ammoniacal liquor, 4s. 5·72d.; making a return from residual products of 9s. 6·76d. per ton of coal carbonized, or 71·9 per cent. of the cost of the coal. The working statement showed that the total quantity of gas sold during the twelve months was 173,122,300 cubic feet, or an increase of 7,606,268 cubic feet, or 4·6 per cent.

GAS AND WATER COMPANIES' STOCK AND SHARE LIST.

Referred to on p. 663.

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p.c.	GAS COMPANIES.			£ s. d.
590,000	10	April 17	10½	Alliance & Dublin 10 p.c.	19—20	..	5 5 0
100,000	10	,,	7½	Do. 7 p.c.	13—14	..	5 7 2
200,000	5	May 14	6½	Bombay, Ltd.	5⅝—6	..	5 8 4
140,000	5	,,	6½	Do. New, £4 paid	4—4½	..	5 15 7
380,000	Stk.	Feb. 26	12	Brentford Consolidated	240—245	..	4 18 0
286,700	,,	,,	9	Do. New	178—183	..	4 18 4
50,000	,,	,,	5	Do. 5 p.c. Pref.	131—136	..	3 13 6
206,250	,,	Dec. 11	4	Do. 4 p.c. Deb.	110—113	..	3 10 10
220,000	Stk.	Mar. 12	10⅜	Brighton & Hove Orig.	212—217	..	4 19 1
246,320	,,	,,	7½	Do. A. Ord. Stk.	151—156	..	4 19 4
460,000	20	Mar. 31	10	British	39—40	..	5 0 0
103,000	Stk.	Mar. 12	6	Bromley, 5 p.c. "A"	118—123	..	4 17 7
165,700	,,	,,	4½	Do. 3½ p.c. "B"	90—95	..	4 14 9
500,000	10	May 14	7	Buenos Ayres (New) Ltd.	11¼—11⅜	..	5 19 2
250,000	Stk.	Dec. 30	4	Do. 4 p.c. Deb.	94—96	..	4 3 4
150,000	20	Mar. 12	8½	Cagliari, Ltd.	23—25	..	6 12 0
100,000	10	Sept. 26	10	Cape Town & Dis., Ltd.	15—16	..	6 5 0
50,000	50	May 2	6	Do. 6 p.c. 1st Mort.	52—54	..	5 11 1
1,375,000	Stk.	Feb. 26	5	Commercial 4 p.c. Stk.	103—106	..	4 14 4
503,750	,,	,,	4½	Do. 3½ p.c. ,,	99—102	..	4 13 2
407,812	,,	—	3	Do. 3 p.c. Deb.,,	89—92	..	3 5 3
800,000	Stk.	Dec. 11	8	Continental Union, Ltd.	128—133	..	6 0 4
200,000	,,	,,	7	Do. 7 p.c. Pref.	140—145	..	4 16 7
575,000	Stk.	Feb. 26	5½	Crystal Palace Ord. 5 p.c.	113—118	..	4 10 2
60,000	,,	,,	5	Do. 5 p.c. Pref.	120—125	..	4 0 0
106,158	,,	Jan. 15	5	Do. 5 p.c. Deb. Stk.	137—140	..	3 11 5
486,090	10	Jan. 29	10½	European, Ltd.	18—19	..	5 10 6
354,060	10	,,	10½	Do. £7 10s. paid	13—14	..	5 12 6
15,243,200	Stk.	Feb. 12	4 1/16	Gas-light and Coke	4 p.c. Ord.	85—87	.. 5 1 2
2,600,000	,,	,,	3½		3½ p.c. max.	85—87	.. 4 0 6
3,799,735	,,	,,	4		4 p.c. Con. Pref.	108—110	.. 3 12 9
4,193,975	,,	Dec. 11	3		3 p.c. Con. Deb.	88—90	.. 3 6 8
252,500	Stk.	Mar. 12	5	Hastings & St. L. 3½ p.c.		90—95	.. 5 5 3
70,000	10	Oct. 30	8	Hongkong & China, Ltd.		15—16	.. 5 0 0
3,800,000	Stk.	May 14	10	Imperial Continental		203—208	.. 4 16 1
473,600	Stk.	Feb. 12	3½	Do. 3½ p.c. Deb. Red.		100—103	.. 3 8 0
165,242	Stk.	Mar. 12	6	Lea Bridge Ord. 5 p.c.		115—120	.. 5 0 0
561,000	Stk.	Feb. 26	10	Liverpool United A		217—219	−1 4 11 4
718,100	,,	,,	7	Do. do. B		166—168	.. 4 3 4
306,083	,,	Dec. 31	4	Do. do. Deb. Stk.		112—114	.. 3 10 2
75,000	5	Dec. 11	5	Malta & Medn., Ltd.		4½—5	.. 5 0 0
560,000	100	April 1	5	Met. of Melbourne	5 p.c. Deb.	103—107	.. 4 13 6
					4½ p.c. Deb.	102—104	+1 4 6 7
250,000	100	,,	4½	Monte Video, Ltd.		10—11	.. 6 7 4
541,920	20	Nov. 13	3½	Newc'tle & G'tesh'd Con.		104—105	.. 4 5 9
1,515,892	Stk.	Feb. 20	4½	Do. 3½ p.c. Deb.		96½—97½	.. 3 11 10
376,855	Stk.	Jan. 2	3½	Oriental, Ltd.		140—145	.. 5 10 4
300,000	Stk.	May 14	8	Ottoman, Ltd.		6—7	.. 5 0 0
600,000	5	Mar. 31	7				

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p.c.	GAS COMPANIES.			£ s. d.
105,005	Stk.	Jan. 15	6½	Ply'mth & St'house 5 p.c.	127—132	..	4 12 9
851,070	10	April 30	7	River Plate Ord.	11¼—11⅜	..	5 19 2
300,000	Stk.	Dec. 30	4	Do. 4 p.c. Deb.	95—97	..	4 2 6
250,000	10	April 17	8	San Paulo, Ltd.	12—13	..	6 3 1
135,000	Stk.	Mar. 12	10	Sheffield A	239—241	..	4 3 0
209,984	,,	,,	10	Do. B	237—240	..	4 3 4
523,498	,,	,,	10	Do. C	237—239	..	4 3 8
103,235	Stk.	Mar. 31	5	Shrewsbury Ord. 5 p.c.	111—114	..	4 7 9
6,000,000	Stk.	Feb. 12	5⅜	South Met., 4 p.c. Ord.	119—122	..	4 7 4
1,780,000	,,	Jan. 15	3	Do. 3 p.c. Deb.	50—92	..	3 5 3
380,940	Stk.	May 14	5	Southampton Ord.	105—110	..	4 10 11
87,950	,,	Jan. 15	4	Do. 4 p.c. Deb.	103—106	..	3 15 6
120,000	Stk.	Feb. 26	6	Tottenham and Edmonton	A. 5 p.c.	117—122	.. 4 13 4
300,520	,,	,,	4½		B. 3½ p.c.	56—99	.. 4 10 11
182,380	10	Dec. 30	8	Tuscan, Ltd.		8½—9½	.. 8 8 6
149,900	10	Jan. 2	5	Do. 5 p.c. Deb. Red.		94—96	.. 5 4 2
730,872	Stk.	Mar. 12	5	West Ham, 5 p.c. Ord.		95—100	.. 5 0 0
				WATER COMPANIES.			
780,662	Stk.	Dec. 30	11⅛	Chelsea, Ord.		325—335	+10 3 8 8
150,000	,,	,,	5	Do. 5 p.c. Pref.		148—153	+3 3 5 4
160,000	,,	,,	4½	Do. 4½ p.c. Pref. '75		130—140	.. 3 3 4
175,785	,,	Mar. 31	4½	Do. 4½ p.c. Deb.		137—142	.. 3 3 5
1,720,560	Stk.	Mar. 31	8	East London, Ord.		245—250	+5 3 4 0
654,740	,,	Dec. 11	4½	Do. 4½ p.c. Deb.		142—147	.. 3 1 3
1,282,943	,,	,,	3	Do. 3 p.c. Deb.		96—98	.. 3 1 3
700,000	50	Dec. 11	10†	Grand Junction	10 p.c. max.	140—145	.. 3 8 11
310,000	Stk.	Mar. 31	4		4 p.c. Deb.	123—128	.. 3 2 6
708,000	Stk.	Feb. 26	10½	Kent		300—310	.. 3 7 9
160,000	,,	,,	7	Do. New, 7 p.c. max.		200—210	+2½ 3 6 8
1,043,800	100	Dec. 30	11	Lambeth, 10 p.c. max.		320—330	.. 3 6 8
406,200	100	,,	8½	Do. 7½ p.c. max.		225—235	.. 3 12 4
350,000	Stk.	Mar. 31	4	Do. 4 p.c. Deb.		122—127	.. 3 3 0
500,000	100	Feb. 12	12 6/16	New River, New Shares		430—440	.. 2 18 2
1,000,000	Stk.	Jan. 29	4	Do. 4 p.c. Deb.		123—128	.. 3 2 6
902,300	Stk.	Dec. 11	7½†	South-wark and Vauxhall	Ord.	282—287	+9 2 12 3
126 500	100	,,	7½†		7½ p.c. max.	215—225	.. 3 2 3
489,200	Stk.	,,	5		5 p.c. Pref.	150—155	+1 3 4 6
1,019,585	,,	Mar. 31	4		4 p.c. A Deb.	122—127	.. 3 3 0
1,155,066	Stk.	Dec. 11	10	West Middlesex		305—315	+5 3 3 6
200,000	,,	,,	4½	Do. 4½ p.c. Deb.		138—143	.. 3 2 11
200,000	,,	Mar. 12	3	Do. 3 p.c. Deb.		95—97	.. 3 1 10

† Next dividend will be at this rate.

A FAVOURABLE POSITION AT NEATH.

Mr. A. R. Browning, the Gas Manager to the Neath Corporation, in his report on the working of the department during the year ending March 31, stated that there was a gross profit of nearly £4830, which was £565 more than the previous year. The gas-rental showed an increase of £750; the total receipts being £16,155, or £822 more. The quantity of coal carbonized was 8828 tons, which produced 89,393,000 cubic feet of gas. The gas made per ton of coal was equal to 10,126 cubic feet, of an average illuminating power of 16 candles. These results were produced by the coal without the aid of cannel or other enricher. After seeing the favourable results of the past year's working, Mr. Browning said he could with confidence recommend a reduction, as from September next, in the price of gas from 3s. 2d. to 3s. per 1000 cubic feet; the prepayment consumers to have an extra 2 cubic feet for a penny. This would benefit the consumers to the extent of about £600 on the twelve months. The new works, he added, were carried out successfully, and all matters concerning them were at present satisfactory. It was recommended that the balance of net profit should be appropriated as follows: £1139 interest on loans and bank; £200 to the depreciation fund account; £2580 to the repayment account for the reduction of principal; and £1339 to a suspense account for extra work in the erection of retort-benches in the new retort-house during the past year. This would leave a balance of £4408 to be carried to the next account. When moving the adoption of the report by the Council, Mr. Hopkin Jones congratulated Mr. Browning on the efficient manner in which he had carried out his duties, and devised and superintended the improvements which had been from time to time effected. When he began his duties some twenty years ago, he had an uphill task, financially and otherwise. He had, however, battled successfully with his difficulties, and had exerted himself to modernize the works. The report was adopted.

ELECTROLYSIS AND ILLUMINATING POWER AT LEEDS.

The Leeds Gas Committee have lately had their attention called in a very unpleasant manner to the danger arising from the escaping current from the electric tramways. A short time since, a leakage of gas occurred in Kirkgate; and on investigation, a hole in a 1-inch pipe was found which could only be accounted for on the assumption that the electricity from the tramway had eaten away the metal. This, of course, led to further examination; and a 12-inch gas-main close to the damaged pipe was laid bare. Here there were found, in a space of 6 square inches, seven holes, which were evidently ascribable to the same cause. In none of these cases, however, was the main (which was a comparatively new one) quite eaten through. This, it is stated, does not constitute the whole of the evidence that destruction is being wrought by the almost continuously escaping electricity; for the Electric Lighting Department have made similar discoveries with regard to the injurious effects which the current is having upon their cables, while tests made by the Gas Department conclusively show that the mains in other parts of the city are also subject to attack. In view of the serious condition of affairs thus revealed, the Gas Committee have resolved that no time shall be lost in seeking a remedy. They have therefore appointed a Special Committee, consisting of Alderman Lowden (Chairman), Alderman Lupton, Mr. Heald, and Mr. Ratcliffe, to confer with the Electric Lighting and Tramways Committees, and, if necessary, consult an electrical expert. The questions of supplying gas for power purposes at a reduced rate and of lowering the standard illuminating power, have also been under the consideration of the Committee. Alderman Lowden, in conjunction with the General Manager (Mr. R. H. Townsley) has been specially engaged making preparations for placing before the Council at an early date arguments in favour of the adoption of both proposals; and a Sub-Committee has been appointed to formulate a scheme.

THE DIFFERENCES OF THE WELSBACH COMPANY WITH THE AUSTRIAN COMPANY.

Some interest will be manifested in regard to the proceedings at the recent meeting of the Austrian Incandescent Gaslight and Electricity Company of Vienna, whose "A" shares are largely held by the Welsbach Incandescent Company, and the "B" shares by Baron Auer von Welsbach. The report presented to the meeting, in referring to the abortive extraordinary meeting which was held towards the end of March, stated that, in February, 1903, the two largest shareholders—the Welsbach Company and Baron Auer—informed the Directors that they had entered into negotiations respecting the separation of the "A" branch of the business from the "B" branch; and they submitted a scheme for this purpose. As a result, the Directors convened an extraordinary meeting to deal with the question of separation; but as the two largest shareholders had not in the meantime arrived at an agreement on all points, and as the "B" shares were, therefore, not represented at the meeting, the latter was powerless to act in the matter. Since then, the Directors have not received a scheme approved by both parties; and the question of separation has consequently been allowed to rest until further notice. The shareholders approved the payment of a dividend at the rate of 30 per cent. on the "A" shares, as compared with 40 per cent. in 1901.

It should be explained that the suggested division of the Austrian Company's business applies to the separation of the manufacture of incandescent gas-burners, mantles, &c., from the construction of the osmium incandescent electric lamp. Although the manufacture of

CARBURETTED WATER-GAS APPARATUS

Merrifield—Westcott—Pearson Patents.

The Economical Gas Apparatus Construction Co., Ld.

W. H. PEARSON, Chairman.
W. H. PEARSON, Junr., Deputy-Chairman.
J. T. WESTCOTT, M.E., Manager.
L. L. MERRIFIELD, M.Inst.M.E., Engineer.

London Offices: 19, ABINGDON STREET, WESTMINSTER, S.W.
American Offices: TORONTO. TELEGRAPHIC ADDRESS: "CARBURETED, LONDON."

CARBURETTED WATER-GAS ENGINEERS.

The above Company have erected since 1893, or are now erecting, their Universal Type of Carburetted Water-Gas Plant at the following Gas-Works:—

	Cub. Ft. Daily.		Cub. Ft. Daily.		Cub. Ft. Daily.
BLACKBURN	1,250,000	ST. CATHERINES (Remodelled)	250,000	ACCRINGTON	500,000
WINDSOR ST. WORKS, BIRMINGHAM	2,000,000	KINGSTON, PA.	125,000	TONBRIDGE	300,000
SALTLEY WORKS, BIRMINGHAM	2,000,000	PETERBOROUGH, ONT.	250,000	STRETFORD	500,000
COLCHESTER	300,000	WILKESBARRE, PA.	750,000	OLDBURY	300,000
BIRKENHEAD	2,250,000	ST. CATHERINES (Second Contract)	250,000	TODMORDEN	500,000
SWINDON (New Swindon Gas Co.)	120,000	BUFFALO, N.Y.	2,000,000	SALTLEY, BIRMINGHAM (Third Contract)	2,000,000
SALTLEY, BIRMINGHAM (Second Contract)	2,000,000	WINNIPEG, MAN.	500,000	YORK (Second Contract)	750,000
WINDSOR ST., BIRMINGHAM (Second Contract)	2,000,000	COLCHESTER (Second Contract)	300,000	ROCHESTER (Second Contract)	500,000
HALIFAX	1,000,000	YORK	750,000	NEWPORT (MON.)	250,000
TORONTO	250,000	ROCHESTER	500,000	TOKIO, JAPAN	1,000,000
OTTAWA	250,000	KINGSTON, ONT.	300,000	PERNAMBUCO (Brazil)	125,000
LINDSAY (Remodelled	25,000	CRYSTAL PALACE DISTRICT	2,000,000	MALTON	150,000
MONTREAL	500,000	DULUTH, MINN.	300,000	DULUTH, MINN. (Second Contract)	300,000
TORONTO (Second Contract Remodelled)	2,000,000	CATERHAM	150,000	BROCKVILLE (ONT.)	250,000
BELLEVILLE	250,000	LEICESTER	2,000,000	SMETHWICK	500,000
OTTAWA (Second Contract)	250,000	ENSCHEDE (HOLLAND)	150,000	GRAVESEND	300,000
BRANTFORD Remodelled)	200,000	BUENOS AYRES (RIVER PLATE CO.)	700,000	NEWPORT MON. (Second Contract)	250,000
		BURNLEY	1,500,000	TORONTO (Third Contract)	750,000
		KINGSTON-ON-THAMES	1,750,000		

Complete Gas-Works at NELSON, BRITISH COLUMBIA.

LEEDS, 1,800,000 C. Ft. LEICESTER (2nd Cont.), 1,000,000 C. Ft. NEWCASTLE-ON-TYNE, 1,800,000 C. Ft.
MONTREAL, ONT. (Second Contract) . . . . . 1,800,000 Cub. Ft.

this lamp is stated to have made some progress in Germany, the report of the Austrian enterprise states that a site for the erection of a factory for the production of the lamp on a suitable scale was only acquired in the second half of 1902, and that the actual transfer to the new premises only took place about the end of the financial year. This branch of the business, the report adds, has not proved remunerative.

MONAZITE SAND AND THORIUM.

The Comfortable Position of the Welsbach Company.

The Welsbach Company are in a position to take a cheery view of the monazite sand and thorium question. The comments which have recently appeared on the subject suggested to a representative of the "Westminster Gazette" that he should make inquiries into it at the head office of the Company. "'The matters commented on,' said one of the principal officials, 'are, of course, familiar knowledge to incandescent mantle makers, so far as the source of the supply of thorium is concerned. But I am not aware of the existence of any disability on the part of the Welsbach Company in the way of supply of this absolutely essential constituent of the mantle. We obtain our thorium in fluid form from the Austrian Incandescent Mantle Company, in which the London Welsbach Company, as you know, holds a controlling interest. It is manufactured at Atzgersdorf, near Vienna, and is supplied to all the Continental Welsbach Companies, and to them alone. The monazite sand from which our thorium is produced is supplied by Mr. John Gordon, from Espirito Santo; and, so far from any shortage, we have enough thorium in stock to supply our needs for years to come. We are the only English Company using this fluid. We know nothing about a corner in the Brazilian monazite sand; and, in any case, therefore, have nothing to do with it. If such a thing were possible, it would have a very serious effect upon the industry, as Brazil is the chief source of supply.' It is interesting to note that a few years ago this sand could be gathered free of cost, but that now the Brazilian Government exacts a duty of 40 per cent. on the gross value of the sands extracted. The Board of Trade have been making careful inquiries into other sources of supply, from which it appears that, with the exception of North and South Carolina, the deposits of monazite sand are confined to the Brazilian States of Espirito Santo and Bahia. About 240 Welsbach mantles are made from a kilo of thorium. The price of fluid thorium in the early days of incandescent lighting was £5 per kilo; it is now somewhere about 15s!" The comparison should be not between the price of fluid thorium in the "early days of incandescent lighting" and now, but between the time when monazite sand became available in large quantities, at a comparatively cheap rate and now.

PROTECTION OF PIPES FROM ELECTROLYSIS.

The Preston Clause.

In the last two numbers of the "JOURNAL," reference was made to the action taken by the Exeter and Preston Gas Companies to safeguard their pipes from electrolytic action as the result of the use of electricity for tramway purposes, and to ensure compensation for any injury done to them; and in the "Electric Lighting Memoranda" on the 19th ult., we gave the text of a clause which, the first-named Company had succeeded in getting inserted in a Bill promoted by the Corporation. Last week we mentioned that the promoters of the Preston and Horwich Tramways Bill had agreed to the insertion therein of a clause protecting the pipes of the Preston Gas Company. It runs as follows:—

The [Tramways] Company shall not alter the position of any main or of any pipe of the owners under the powers contained in section 30 of the Tramways Act, 1870, contrary to the provisions of, and regulations under, any Act of Parliament for the time being in force relating to the owners; and shall, in the case of any alteration of the position of any such mains or pipes, relay the same, unless otherwise agreed between the Company and the owners, at a depth not less than that at which such main or pipe was previously laid, and so as in all cases to leave a covering, where practicable, of at least 30 inches from the surface of the road above such main or pipe. The provision of section 30 sub-section (1) of the Tramways Act, 1870, shall extend and apply to the case of the construction of the tramways preventing or interfering with the future repair of such main or pipe.

If within seven days after a notice under section 30 of the Tramways Act, 1870, as to alteration of position of mains or pipes, shall have been served upon the owners, the owners so elect, such owners shall themselves execute all such alterations to their mains or pipes; and the reasonable cost of executing such alterations shall be repaid by the Company to such owners: Provided always that such alterations shall be carried out to the reasonable satisfaction of the Chief Engineer of the Company; and all works affecting the tramways shall be restored and made good with the least possible delay, and shall be carried out so as to cause the least possible interference with, or impediment to, the traffic on the tramways.

The bridge by this Act authorized to be constructed across the River Ribble, and the approaches thereto, shall be constructed of a sufficient width to admit of mains or pipes of the owners being carried thereover, and shall be so constructed as to leave a sufficient amount of covering over any such mains or pipes in the footpath or roadway of such bridge.

If it be proved that any injury or damage to any gas or water pipes, or other metallic pipes, structures, or substances of the owners shall have resulted from fusion or electrolytic action caused by any currents generated or passing through any cable used by the Company for the purpose of electric traction under this Act, nothing in this Act shall take away any right (if any) which the owners would have had to compensation for any injury, loss, or damage if this Act had not been passed.

Messrs. Biggs, Wall, and Co. have received an order for two of their "Rapid" charging machines from the Weston-super-Mare Gas Company.

Wright's " " " "
New Century "EUREKA"
Gas Cookers " " "
Give every satisfaction.

MUNICIPAL LOANS AND MUNICIPAL TRADING.

Memorial to the Bank of England.

The Secretary of the Industrial Freedom League (Mr. P. S. Bridgeford) sends a copy of a memorial on the subject of municipal loans which has been signed by members of the League and other gentlemen, and addressed to the Governor and Company of the Bank of England. It is accompanied by a letter from the President (Lord Avebury, P.C., D.C.L.), commending the subject to the consideration of the Bank, and the acknowledgment thereof by Mr. S. Hope Morley, the Governor, who says the Court of Directors are fully alive to the importance of the matter referred to. The memorial is in the following terms.

We, the undersigned, desire to draw the attention of the Governors of the Bank of England to the policy of commercial adventure upon which many local authorities are now embarking, and which, if continued, will greatly increase the amount and seriously affect the character of municipal stocks.

Trading enterprises of various kinds are now being undertaken by municipalities, many of them embracing inventions of no doubt a highly-interesting and useful character, but which are continually being improved, and are therefore unsuited for the investment of municipal funds, especially having regard to the fact that the municipal stocks of the larger cities are authorized trustee investments.

The most recent returns show that the debt of local authorities of England and Wales amounts to £300,000,000, while the capital amount of their strictly trading concerns (exclusive of water) has doubled itself in the last two years.

Your memorialists feel that there are other strong reasons that might be urged, as, for instance, the check to private enterprise. Again, the fact that such enterprises require the closest attention, if heavy loss is to be avoided, must prevent municipalities from being able to give sufficient time and thought to the important duties which fall within the scope of their proper functions. Your memorialists do not, however, urge these or other reasons on the present occasion, as, though important, they are not of a financial character.

Your memorialists respectfully submit that proposals of the municipalities for further loans for trading purposes, or of municipalities which have charged their rates to any serious extent for such somewhat speculative purposes, should be discouraged, and that all loans to municipalities should be kept within prudent limits.

Proposed Reduction in Price at Salford.—The Salford Town Council will be asked at to-morrow's meeting to consider the following resolutions of the Gas Committee: (*a*) That from and after June 30 the initial price of gas be reduced by 2d. per 1000 cubic feet to all ordinary consumers throughout the area of the gas supply, such reduced price to be subject to the existing discounts; and (*b*) that a further reduction of 1d. per 1000 cubic feet be made in the price of gas to consumers of 250,000 cubic feet and upwards per quarter.

PORTSMOUTH WATER COMPANY.

The Half-Yearly Meeting of this Company was held on the 21st ult.—Mr. W. GRANT, J.P., in the chair.

The SECRETARY (Mr. J. L. Wilkinson) having read the notice convening the meeting, the report of the Directors, some statistics from which were given in the "JOURNAL" last week, were presented.

The CHAIRMAN, in moving the adoption of the report, congratulated the proprietors on the fact that the Company had recovered, to all intents and purposes, from the generous gift or concession which they made to the town two years and a half ago by altering the basis of their charges for water. This change entailed a loss at the time of £5000 a year; and he thought it was gratifying to them that their water-rental had recouped this sum in so short a time. In the course of the past ten years, the rental had increased 27 per cent., actually received; and if they looked at it from the point of view of their not having made this concession of £5000, it would have increased by 38 per cent., which showed the great elasticity in the growth of the rental. In the half year reported upon, it had increased even more satisfactorily than in the corresponding period of 1901-2; being £1158 more. At the same time they had pumped 800,000 gallons per day less water, as the result of the efforts they had consistently made for many years to diminish the waste. So that, while the rental was increasing at such a satisfactory rate, their expenses were being reduced by the fact that they were pumping much less water. As they owed £37,000 on capital account, they could not, in justice to the whole body of the town, recommend the paying of the back-dividends, the effect of which would be to increase their indebtedness. When the money was available, the Directors would be only too pleased to consider its distribution; but it would be premature to do so at present.

Colonel LANYON OWEN seconded the motion,

After a few remarks from shareholders, the motion was carried, and a dividend at the rate of 10 per cent. per annum was declared for the half year ending the 31st of March.

TORQUAY CORPORATION WATER SUPPLY.

Dr. Frankland on the Quality of the Water.

A report by Professor Percy Frankland, F.R.S., on the water supply of the town, was read at a recent meeting of the Torquay Town Council. Dr. Frankland visited the water-works on the 25th of April, and took several samples of water for analysis. As regards the water-shed, he noticed the great improvements which have been effected since the Corporation, under their Act of 1837, purchased it. Farmhouses in dangerous proximity to the streams have been taken down, fences

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have been erected to keep cattle from approaching the watercourses, and trenches dug to prevent the water running off the surface of the land from flowing directly into the streams. Dr. Frankland is of opinion that the improvements have been carried out on a well conceived plan, and that they are calculated to preserve the supply. With regard to the chemical and bacteriological results of his examination of the water furnished to the town, it is but slightly turbid, of a very pale yellow colour, and contains only a moderate amount both of organic matter and bacterial life. The removal of all habitations from the watershed and the other improvements made on the gathering-ground have guaranteed to Torquay a source of water supply which, in respect of freedom from suspicion, ranks with the best upland surface supplies in the kingdom. The watershed is favoured by Nature in yielding a large quantity of spring water; while, owing to the relatively small area of peat, the supply contains only a very moderate proportion of vegetable organic matter. The water also contains such a small amount of lime and magnesia, that it possesses all the well-known advantages of very soft water; while its slightly alkaline reaction prevents it from having any solvent power on lead. Great satisfaction was expressed at the nature of the report, which, it was claimed, showed filtration of the water to be unnecessary.

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

The Gas Committee of the Glasgow Corporation yesterday fixed their coal contracts for the current year. It is intimated that the purchases which have been made are on fairly favourable terms for the Corporation. The total quantity purchased amounts to nearly 700,000 tons. As usual, the larger portion of the coal is composed of splints, mains, and ells, of which some 400,000 tons have been contracted for. The average price for these is about 6d. per ton less than the rate last paid. At this time last year, the prices reported were from 6d. to 9d. per ton less than had been paid in the previous year. The present contracts have been fixed in lots varying from 2000 up to about 50,000 tons. First-class cannels have been bought in lots of from 3000 to 12,000 tons, at a reduction of about 2s. 6d. per ton. Second and third qualities of cannel have been secured in quantities of from 1000 to 60,000 tons, at prices from 1s. 6d. to 2s. less than last year. About 50,000 tons of rich Fife shale or cannel have been bought at a similar reduction in price. It will be observed from these notes that cannel—and particularly cannel of the better quality—has sustained the largest reduction in price, which, I suppose, is due to the withdrawal of the demand for enrichment purposes that has accompanied the lowering of the illuminating power of gas and the introduction of benzol. The swing of the pendulum in favour of cannel will come when it is discovered to be cheaper than benzol; but, unless there should be an alarming scarcity of cannel, it is hardly to be expected the demand for it will ever be so great as to raise the price for it to what it was ten or twelve years ago.

The anti-Progressives in the Falkirk Town Council, in the matter of the proposed new gas-works, have this week been hoist with their own petard. They succeeded in overturning the resolution of the Council to erect the works at Thornhill, out of a regard for the site at Parkhouse, of which one of their number was the champion; and they obtained a remit to Messrs. Black and Strang, architects, of Falkirk, to report on the suitability of the Parkhouse site. The firm were, on the instruction of the Council, supplied by Mr. J. Kincaid, the Manager, with information as to the weight of the buildings which it would be necessary to erect; and they have reported, in a document which does not occupy more than a page of foolscap, that they most emphatically cannot recommend Parkhouse as a site for gas-works. The report was submitted to the Special Committee on Gas-Works yesterday; and the Committee unanimously resolved to recommend the Town Council to abide by the advice of the architects. What may happen next is, of course, matter of conjecture. The Thornhill site is, I suppose, still open to the Corporation; but the tactics of the party who came into power at the municipal election last November have led to the loss of at least a year in the erection of new works, which are more urgently required in Falkirk than in any other town in Scotland.

The resignation of Mr. A. MacPherson of his post of Manager of the Kirkcaldy Gas Company, Limited, is an event which cannot be passed over without notice. It brings to a close a career which has been a long and a continuous success, and which has been full of much happiness to himself and of pleasure to all with whom he was associated. To every subject of interest he applied a vigorous intellect, and in practice the benefit of his Company was his first concern. His cheerful nature made him a host in every gathering. He was twice President of the North British Association of Gas Managers—on the last occasion in 1892, when he carried through successfully the proceedings connected with the unveiling of the bust of William Murdoch in the Wallace Monument at Stirling. I am sure that there are few whose retirement would be more regretted, and am equally confident that every good wish from a very wide circle of friends will accompany him.

Lord Low's decision of the action by the James Keith and Blackman Company, Limited, against the Glasgow Exhibition Association brings to an end, unless it be reclaimed, a dispute which is felt to be the more unfortunate in that it is the only litigation of the kind which the promoters have been involved in with exhibitors. The pursuers must regret that they did not accept the tender which the defenders made, with regard to which it is to be noted that it bears out the great common sense with which the Exhibition was conducted, seeing that it exceeded by a little the amount which the Judge has, after proof, allowed. The effect is that the burden of the expenses will fall most heavily upon the pursuers; and thus the decree they have obtained will, in all probability, be a loss instead of a gain to them.

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The annual accounts of the Perth Corporation Gas Department have not yet been got ready for presentation to the Town Council; but it is reported that they show quite satisfactory results. There has been, it is stated, a small decrease in the revenue from the sale of gas, but an increase in the receipts from residual products. It is probable that the price of gas will be retained at 3s. 2d. per 1000 cubic feet, for lighting purposes; but Bailie Cuthbert, the Convener of the Works Committee, is desirous of encouraging its use for motive power purposes, and it is his intention to propose a large reduction in the price of gas so employed—probably making it as low as 2s. 6d. per 1000 cubic feet. He had the same wish in his mind last year, but was unable to get his colleagues to agree to it.

The Dundee Corporation gas accounts for the past year are better reading than they have been for some time. I say this apart from the financial result which has been attained, because they are now based upon a system of book-keeping which permits them to be understood by the ordinary reader, and because the practice of allowing for depreciation has been introduced. It has long been complained that the financial arrangements of the undertaking were defective; and the feeling was general, though not universal, that something ought to be done to put them on a proper footing—when times were easier. It has turned out, as it often does, that the improvement has had to be effected, not when times improved, but when things reached their worst, and had, perforce, to be mended. It would scarcely be proper, considering what the business has come through during the year, to look very narrowly into the results; and if I recall that the estimated surplus was £3321, and is really only £682, it is not with a disposition to minimize the value of the work done by Mr. Yuill, but to emphasize the fact that, but for an outlay of about £5000 upon the reconstruction of the retort-bench—even working out a business which he had not prepared the estimates for—he would have more than realized the end arrived at. I think we are justified by this circumstance in expecting that, though the large reduction of 6d. per 1000 cubic feet is being made in the price of gas, with everything, from inception to accomplishment, in the hands of one man, the step will be a safe one. Everything, in short, which can be seen by outsiders, gives good ground for entertaining the belief that the gas undertaking has got round the corner of its difficulties, and has now a clear path before it, in which it may walk profitably. But the financial burden upon the undertaking is very great; and it will probably be advisable not to expect any astonishing results. It is exceedingly well to be able so soon to reduce the price of gas to 3s. per 1000 cubic feet.

It is announced from Arbroath that there was an increase in the make of gas during the past year, as compared with the preceding twelve months, of 2½ million cubic feet. There are over 6000 meters in use; and the average consumption per meter was 11,000 cubic feet—about 100 cubic feet more than in the previous year. Unaccounted-for gas amounts to 7·7 per cent. of the make, which is a reduction of 2·2 per cent. During the year, 148 hire-purchase gas-cookers, and 346 slot cookers were fixed. The Gas Committee anticipate that they will be in a position to reduce the price of gas from 4s. 4½d. to about 3s. 6½d. per 1000 cubic feet. The Committee recently appointed Mr. A. Gillespie, of Glasgow, to report as to the present value and condition of the gas-works, and as to the provision for depreciation and other questions. Mr. Gillespie visited the works at the end of last week; and he has expressed the opinion that the Corporation have acted wisely in their recent resolution to renew portions of the plant, and to fit up new scrubbers, pumps, and engine. Otherwise he considers that the works are in capital order.

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *June 6.*

Sulphate of Ammonia.

There has been improved demand for immediate delivery, and prices have been fully maintained, the closing quotations being £12 13s. 9d. per ton f.o.b. Hull, £12 16s. 3d. per ton f.o.b. Liverpool, and £13 per ton f.o.b. Leith. For June delivery these prices are also quoted, but buyers are not so much interested in the whole month. For July-September, f.o.b. Leith, £12 15s. per ton is generally quoted by makers, and £12 12s. 6d. per ton for July-December delivery, but there are still speculative sellers at less money.

Nitrate of Soda.

This is quiet at 9s. 4½d. per cwt. for ordinary, and 9s. 7½d. for refined quality.

LONDON, *June 6.*

Tar Products.

There is very little business to report. Owing to the holidays, the markets are very quiet. Pitch seems to be a little easier all round; the South Wales buyers having secured all they require for early delivery. In benzol, there is nothing of importance doing. A further quantity of 50-90 per cent. was placed at 7d., delivered to consumers' works, for home consumption; while 8½d. was declined for 90 per cent. up to the end of the year. In solvent and toluol, there is nothing fresh to advise. The position of crude carbolic remains unchanged. There are still buyers for forward delivery; but the demand for prompt has fallen off. Business is reported at 1s. 6¼d. to 1s. 6½d.; but only for small quantities. The market for creosote is quiet, and there is more offering both in London and the provinces. In anthracene, one or two small parcels of "A" (40 per cent.) have been sold at 1¾d. per unit, early delivery; but makers still decline to accept anything like existing quotations for forward delivery. As regards tar, some large contracts have recently been let at excessively high prices; and even at the present values of the products, it is difficult to see how the distillers can hope to make same remunerative.

The average values during the week were: Tar, 21s. 6d. to 32s.;

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pitch, London, 56s. 6d. to 57s.; east coast, 53s. to 53s. 6d.; west coast, 52s. to 52s. 6d. Benzol, 90 per cent., 8¼d. to 8⅜d.; 50-90 per cent., 7d. to 7¼d. Toluol, 7d. to 7¼d. Crude naphtha, 3d.; solvent naphtha, 7d. to 8d.; heavy naphtha, 9d. Creosote, London, 1¼d. to 1⅜d.; North, 1⅛d. to 1¼d. Heavy oils, 2d. to 2 1/16d. Carbolic acid, 60 per cent., 1s. 6d. to 1s. 6½d. Naphthalene, 32s. 6d. to 40s.; salts, 21s. to 24s. Anthracene, "A" quality, 1⅜d. to 1⅝d.; "B" quality, 1d. nominal.

Sulphate of Ammonia.

The market is decidedly firmer, and there is more demand, especially for June shipment. Beckton are reported to have placed a considerable quantity at £12 15s., and now ask £12 17s. 6d. for June-July delivery. Another large London Gas Company ask the same price, but on their own special terms. Some quantity was sold on Beckton terms at £12 12s. 6d.; but as a rule dealers now ask £12 15s. for early shipment. In Leith, the position remains unchanged; but makers are very firm in their ideas for prompt delivery, and as a rule ask £13, although business is reported at £12 17s. 6d. for immediate shipment. In Hull, some quantity was placed at £12 15s. for immediate shipment; but the nominal value is £12 12s. 6d. to £12 13s. 9d. for ordinary makes. In Liverpool, the market remains firm; but there is not much offering. The position has decidedly improved, and there is every possibility that prices may be still dearer during next week.

COAL TRADE REPORTS.

Lancashire Coal Trade.

With pits generally throughout Manchester and the surrounding neighbourhood closed from Tuesday last until Tuesday or Wednesday in this week, and with four or five days' stoppages generally throughout other Lancashire districts for the Whitsuntide Holidays, there is not much to report in the way of business. The general situation, however, remains unsatisfactory; and the outlook of the coal trade is causing a good deal of anxiety to colliery owners. In the better qualities of round coal, there is, of course, the usual falling off in the demand due to the season of the year; and though the Whitweek stoppages for the time being check accumulations of stock, a resort to short time will be generally necessary very soon after operations are resumed. Prices are fairly steady at late rates—except where needy holders of surplus output are compelled to force the market—as there is not much advantage to be gained in pushing sales at low prices at this time of the year. At the pit, best Wigan Arley coals remain about 14s. to 14s. 6d. up to 15s. per ton in some special cases, seconds Arley and Pemberton four-feet at 11s. and 11s. 6d. up to 12s. 6d., and common house coals at about 10s. to 10s. 6d. The lower qualities of round coal, as intimated in previous reports, are becoming a difficulty with collieries; and there is a gradual weakening in prices, which are getting down to what most coalowners declare to be an altogether unremunerative basis. At the pit, the commoner sorts of round coal used for steam and forge purposes scarcely average more than 8s. to 8s. 6d. per ton; and on sales for shipment, 3d. to 6d. under these figures is being taken. Special qualities are maintaining something like late rates, and are still quoted at 8s. 9d. to 9s. per ton at the pit. Engine classes of fuel, notwithstanding the considerably lessened production of slack, continue fairly plentiful on the market, and generally have got back to about the prices ruling prior to the advanced rates quoted a few months back. Slack is fairly steady at about 4s. 3d. up to 4s. 9d. per ton for the commoner sorts, 5s. 3d. to 5s. 9d. for medium qualities, and 6s. 6d. to 6s. 9d. up to 7s. for the best descriptions.

Northern Coal Trade.

There has been a rather better demand for coal, and as steamers had accumulated in the loading ports in the holidays, the shipment is now brisk. In the steam coal trade, best Northumbrians are 10s. 9d. per ton f.o.b., second-class steams are 8s. 9d. to 9s. 3d., and steam smalls are 5s. 9d. to 5s. 10½d. The collieries are well employed; but there does not seem to be much pressure in the demand, unless it be for the best classes of coal. Gas coals are tolerably firm, and for occasional cargoes the price is from 8s. 6d. to 9s. per ton f.o.b., according to kind. In the contracts, more interest is felt in those for the Newcastle and Gateshead Gas Company, which are now being slowly settled. The total amount is about 267,000 tons yearly; and a much larger quantity than that has been offered. It is expected that a reduction of 4d. to 6d. per ton on the price of the expiring contracts will be made. The gas coal production seems at present to be well taken up—exports to the Baltic and the Mediterranean being heavy. Gas coke is firm—the production being now at its lowest; while there seems to be a fair consumption. Good sorts for shipment are quoted at from 12s. 3d. to 12s. 9d. per ton f.o.b. in the Tyne.

Scotch Coal Trade.

Trade is quiet for all sorts, though the shipping demand is slightly better. This is really all that can be said at present; matters being in a chaotic state, on account of a proposal by the coalmasters to further reduce wages, which is under consideration of the Conciliation Board. The prices quoted are: Main 8s. to 8s. 3d. per ton f.o.b. Glasgow, ell 8s. 9d. to 10s. 3d., and splint 9s. 3d. to 9s. 6d. The shipments for the week amounted to 246,463 tons—an increase of 4312 tons upon the previous week, and upon the corresponding week of last year of 44,847 tons. For the year to date, the total shipments have been 4,203,453 tons—being an increase of 157,389 tons compared with the same period of last year.

The Sowerby Bridge Urban District Council have placed with Messrs. R. Dempster and Sons, Limited, of Elland, the contract for a new steel tank and telescopic gasholder, as well as a telescopic gasholder to be erected in an existing tank, advertised in the "JOURNAL" early in April.

THE POSITIVE PREPAYMENT

IS PRE-EMINENT.

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SAWER & PURVES,

MANCHESTER.

The New Incandescent Oil-Light Company, Limited, has been registered with a capital of £40,000, in £1 shares, to acquire the patents and rights of the Era Incandescent Oil-Lamp Company, Limited, relating to incandescent oil-lamps and lighting, and certain British patents of H. Pittner and F. Richter relating to incandescent oil-lamps and burners, and to carry on the business of manufacturers of, and dealers in, incandescent lights and other apparatus for increasing the illuminating power of gas, spirit, oil, and other light and heat producing agents, &c. There will be no initial public issue. The first Directors are Mr. Julius Moeller, Mr. L. R. de Fonblanque, and another to be appointed by the Era Incandescent Oil-Lamp Company, Limited.

Workington Gas Supply.—The operations at the Workington gas undertaking for the twelve months ending March 31 have resulted in a gross profit of £4298. Of this amount, interest on capital, sinking fund, and loan repayments claimed £2215, leaving a net profit of £2083. The whole of this surplus is absorbed as follows: To meeting expenditure on new consumers (being an extension of business, and not an ordinary charge on revenue), (*a*) additional mains and services, £197; (*b*) additional meters, £321; wiping off suspense account (value of retort repairs obviated by extension of retort accommodation, £500, other small items £209), £709; wiping off portion of debit balance of £1124, and reducing it to £269, £855. The gross profits represent 17·53 per cent. on the capital outstanding at March 31, or about 9·44 per cent. on the total capital expended up to date.

Briton Ferry Gas-Works Extensions.—The Briton Ferry Urban District Council have resolved, subject to the sanction of the Local Government Board being obtained, to raise a loan of £3000, for the purpose of providing new mains, meters, stoves, &c. Of the amount named, £900 has already been spent. In his report on the working of the undertaking, the Manager (Mr. J. Mogford) states that the profit for the past year amounts to £832, which is a satisfactory result considering the high cost of labour and materials, and the fact that gas at Briton Ferry is cheaper than in any other town of the same size in South Wales. During the past four years the consumption has increased 80 per cent., and the number of consumers by about 150 per cent. The works generally, though not modern, are, he states, in good order, and capable of a larger output than the present make.

Reductions in Price.—The Maidstone Gas Company announce a reduction in the price of gas used for motive power purposes of 2d. per 1000 cubic feet. The Long Sutton (Lincs.) Gas Company have lowered the charge for gas used for lighting 5d. per 1000 cubic feet, to 5s. 5d.; while for cooking, the price has been reduced to 4s. per 1000 feet. On the recommendation of the Gas Committee, the Hereford Town Council have agreed to reduce the illuminating power of the gas from 18 to 15 candles, which will enable them to lower the price, as from the 24th inst., by 3d. per 1000 cubic feet. The Batley gas undertaking has enjoyed an exceptionally prosperous year's working; and, after providing £2000 as usual towards the relief of the rates, it is proposed to make a further reduction in the price of gas. The Gas Committee of the Corporation of Widnes have decided to reduce the price of gas to 1s. 4d. per 1000 cubic feet to small consumers, 1s. 2d. to consumers of over 3 million feet per annum, and 1s. to all users of gas for motive power purposes. The Wigan Gas Committee have reduced the price of gas by 2d. per 1000 cubic feet for all purposes. The price of gas at Neath will be reduced, as from the readings of the meters in September next, from 3s. 2d. to 3s. per 1000 cubic feet; the prepayment consumers to have an extra 2 cubic feet for a penny.

It will be seen, by an announcement which appears elsewhere, that the fourth sale of new ordinary shares in the Portsmouth Water Company, under the Order obtained last year, will be conducted by Messrs. Penney and Clark, at their rooms in Southsea, next Tuesday evening. The shares, of which 2000 will be offered, are of the nominal value of £5, and the dividend thereon is not to exceed 5 per cent.

Exhibitions of appliances for cooking and heating by gas, manufactured by John Wright and Eagle Range, Limited, were opened last Tuesday in the Friends' Meeting Hall, Gloucester Road, Horfield, Bristol—Miss Ball being the lecturer; also in the Parochial Hall, Mallow, and the Temperance Hall, Navenby—Miss Miles being the lecturer in the former, and Miss Silvester in the latter place.

The Wath-upon-Dearne Gas Company's works are being entirely remodelled. A new retort-house is being built to contain five through arches with settings of six retorts, on Waddell's patent regenerator system; and a new set of annular condensers, new exhausters and boiler, and scrubbers are also being erected. The whole of the work has been placed with Messrs. R. Dempster and Sons, Limited, Elland.

The report presented at the thirteenth annual meeting of the Free Labour Association in Southampton, of which Mr. S. W. Durkin, the Manager of the Southampton Gas Company, is a prominent member, showed that the various Committees had been doing good work. Three sections of workmen made applications respecting wages and conditions of work, which were discussed and settled by the parties concerned; the result being that no alterations were made. Several points with regard to Sunday and holiday labour, affecting smaller numbers of men, were referred to the Honorary Secretaries, and these were afterwards settled satisfactorily. There were also matters in which representatives of the Association dealt immediately with the employers, and with numerous claims, &c., from individuals. These facts showed that the influence of the Association is maintained. A general increase in the benefit funds was reported. The Chairman (Mr. P. M. Stewart, J.P.), in moving the adoption of the report, said the Association had done excellent work in settling any question that might arise. The arrangements made amicably at a round-table conference were always more satisfactory than any friction between employer and employed. There must be a combination between capital and labour; and by promoting a friendly feeling, they were doing the best for all concerned. The report was adopted; and the members of the Council (one of whom is Mr. C. Crowther Smith, the Secretary of the Gas Company) were all re-elected.

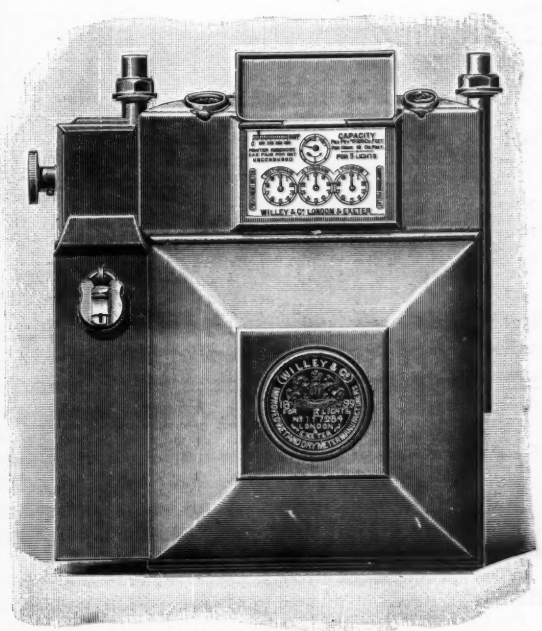
THREE POINTS

of advantage from the many found in our Slot Meters are:

1st.—They are Fraud Proof, and Cannot be tampered with through the Slot.

2nd.—The Slot is closed when the maximum number of Coins have been inserted.

3rd.—Our Price Changing System is the Simplest, Quickest, and most Accurate yet devised.



ALL PARTS INTERCHANGEABLE.

Tens of Thousands in use, and adopted exclusively by many Gas Companies.

WILLEY & CO., LONDON AND EXETER.

The Simon-Carvès Coke-Oven Construction Company, Limited, have placed an order with Messrs. Joseph Taylor and Co., of Bolton, for a 1½-inch plate lead combination saturator, designed to discharge its salt by fishing, self-emptying, or steam discharge, and fitted with double detachable ammonia pipes and detachable acid pipe.

The Water Sterilizer Company, Limited, has been registered with a capital of £1000, in £1 shares, to adopt an agreement with J. Fitzpatrick (as Receiver for the debenture-holders of Marche, Limited, in liquidation); and to turn to account the inventions, patents, and rights acquired thereunder.

Mr. J. H. Brearley, the Engineer and Manager of the Longwood Gas Company, has compiled a pamphlet in which are made known the hire terms in the town for gas-cookers, fires, and boilers, as well as the great advantages to be derived from the use of gas generally. The matter is put together in an attractive form, and cannot fail to substantially assist the Company in their desire to increase the output of gas. A lucid explanation is given of the working of the sliding-scale, by which the Company are governed, and information is furnished with respect to the use of incandescent burners, gas-engines, coke, high-pressure lighting, &c.

WANTED, FOR SALE, CONTRACT, &c., ADVERTISEMENTS IN THIS WEEK'S "JOURNAL."

Situations Vacant.

DRAUGHTSMAN. C. & W. Walker, Donnington.
FOREMAN MAINLAYER. Bolton Gas Department. June 18.
GENERAL FOREMAN. No. 4047.
LAMPLIGHTER, &c. Wells Gas-Works.
MANAGER. Kirkcaldy Gas Company.
SERVICE LAYERS AND FITTERS. Mitcham, &c., Gas Company.
WORKING FOREMAN. Bishops Stortford Gas Company. June 13.
WORKING MANAGER. Atherstone Gas Company. June 22.

Situations Wanted.

CLERK, &c. No. 4033.
DRAUGHTSMAN OR REPRESENTATIVE, &c. No. 4046.
FOREMAN, METER INSPECTOR, &c. Baker, Kidderminster.
GAS LIGHTING SPECIALIST. No. 4043.
MANAGER, &c. No. 4034.
REPRESENTATIVE GAS ENGINEERING FIRM. No. 4045.
RETORT SETTER. No. 4048.
TRAVELLER GAS ENGINEERING FIRM. No 4032.

Sales of Stocks and Shares.

ALDEBURGH GAS COMPANY. June 17.
COLNEY HATCH GAS COMPANY June 17.
CROYDON GAS COMPANY. June 16.
GORING AND STREATLEY GAS COMPANY. June 17.
HORLEY GAS COMPANY. June 17.
MALTA, &c., GAS COMPANY. June 16.
PORTSEA ISLAND GAS COMPANY. June 16.
PORTSMOUTH WATER COMPANY. June 16.
SOUTH ESSEX WATER COMPANY. June 16.
SOUTH METROPOLITAN GAS COMPANY. June 23.
TONBRIDGE GAS COMPANY. June 16.
WEST HAM GAS COMPANY. June 16.

Plant, &c., for Sale.

CONDENSERS, SCRUBBERS, BOILERS, STATION METER, EXHAUSTER, ENGINES, AND PURIFIER. Slough Gas Company.
ENGINES (Gas and Steam), GAS PLANT, PUMPS, WEIGHBRIDGES, &c. Redhill Water-Works.
PURIFIERS AND STATION GOVERNOR, &c. Walton Workhouse, Liverpool.
SCRUBBER, WASHER, STATION METER, EXHAUSTER, TANKS, CONDENSERS, MOUTHPIECES, LANTERNS, &c. Longwood Gas Company.

Plant (Second-Hand) Wanted.

WASHER-SCRUBBER. Holywood Gas Company.

TENDERS FOR

Ammoniacal Liquor (*See* "Tar").

Benzol.

LEIGH (LANCS.) CORPORATION. Tenders by June 13.

Carbon.

BRISTOL GAS COMPANY.

Coal and Cannel.

ALTRINCHAM GAS COMPANY. Tenders by June 7.
BRIDGNORTH GAS DEPARTMENT. Tenders by June 15.
BURY GAS DEPARTMENT. Tenders by June 13.
CAMBORNE GAS COMPANY. Tenders by June 13.
CARDIFF GAS COMPANY. Tenders by June 25.
CARNARVON GAS DEPARTMENT. Tenders by June 25.
CHORLEY GAS DEPARTMENT. Tenders by June 16.
COLWYN BAY GAS DEPARTMENT. Tenders by June 24.
CONGLETON GAS DEPARTMENT. Tenders by June 20.
DUKINFIELD GAS DEPARTMENT. Tenders by June 24
EVESHAM GAS DEPARTMENT. Tenders by June 25.
FENTON GAS DEPARTMENT. Tenders by June 20.
GAINSBOROUGH GAS DEPARTMENT. Tenders by June 23.
GORING AND STREATLEY GAS AND WATER COMPANY. Tenders by June 26.
HARLOW, &c., GAS COMPANY. Tenders by June 24.
HEYWOOD GAS DEPARTMENT. Tenders by June 16.
HOLYHEAD, &c., GAS AND WATER COMPANY. Tenders by June 25.
LANCASTER GAS DEPARTMENT. Tenders by June 12.
LEAMINGTON PRIORS GAS COMPANY. Tenders by June 23.
LEIGH (LANCS.) CORPORATION. Tenders by June 13.
LINCOLN GAS DEPARTMENT. Tenders by June 20.
LYMM GAS DEPARTMENT. Tenders by June 18.
MALTON GAS COMPANY. Tenders by June 13.
MANCHESTER GAS DEPARTMENT. Tenders by June 24.
MARKET HARBOROUGH GAS DEPARTMENT. Tenders by June 27.
MOLD GAS COMPANY. Tenders by June 30.
NELSON GAS DEPARTMENT. Tenders by June 19.
NEWRY GAS DEPARTMENT. Tenders by June 19
SAFFRON WALDEN GAS DEPARTMENT. Tenders by June 29.
SHREWSBURY GAS COMPANY. Tenders by June 13.
STOKE-ON-TRENT GAS DEPARTMENT. Tenders by June 10.
TORQUAY GAS DEPARTMENT. Tenders by June 18.
WORKSOP GAS COMPANY. Tenders by June 22.

General Stores, Lead Piping, &c.

LEIGH (LANCS.) CORPORATION. Tenders by June 13.

Girders and Castings, &c.

COVENTRY GAS DEPARTMENT. Tenders by June 20.

Lime.

CHORLEY GAS DEPARTMENT. Tenders by June 16.
CONGLETON GAS DEPARTMENT. Tenders by June 20.
LEIGH (LANCS.) CORPORATION. Tenders by June 13.

Meters.

LEIGH (LANCS) CORPORATION. Tenders by June 13.
WALLASEY GAS DEPARTMENT. Tenders by June 18.

Pipe Subway, Valve-House, &c.

COVENTRY GAS DEPARTMENT. Tenders by June 20.

Pipes and Fittings, &c.

BRIDGEND GAS AND WATER COMPANY. Tenders by June 15.
CARDIFF GAS COMPANY. Tenders by June 25.
GORING AND STREATLEY GAS AND WATER COMPANY. Tenders by June 26.
LEIGH (LANCS.) CORPORATION. Tenders by June 13.
MOUNTAIN ASH GAS DEPARTMENT. Tenders by June 23.

Retort-House, &c. (Building).

BRITISH GAS LIGHT COMPANY. Norwich. Tenders by June 22.

Retort-House Floor, &c.

SALFORD GAS DEPARTMENT. Tenders by June 25.

Retort Settings and Fittings.

COLWYN BAY GAS DEPARTMENT. Tenders by June 24.

Sulphuric Acid.

CHORLEY GAS DEPARTMENT. Tenders by June 16.
LEIGH (LANCS.) CORPORATION. Tenders by June 13.
MARKET HARBOROUGH GAS DEPARTMENT. Tenders by June 27.

Tar and Ammoniacal Liquor.

ATHERTON GAS DEPARTMENT. Tenders by June 30.
CARNARVON GAS DEPARTMENT. Tenders by June 25.
CHORLEY GAS DEPARTMENT. Tenders by June 16.
FENTON GAS DEPARTMENT. Tenders by June 20.
GREAT WESTERN RAILWAY. Tenders by June 23.
LYMM GAS DEPARTMENT. Tenders by June 18.
NEWARK GAS COMPANY. Tenders by June 18.
READING GAS COMPANY. Tenders by June 22.

Telephone Cable, &c.

GORING, &c., GAS AND WATER COMPANY. Tenders by June 26.

NOTICES TO CORRESPONDENTS, ADVERTISERS, AND SUBSCRIBERS.

No notice can be taken of anonymous communications. Whatever is intended for insertion in the "JOURNAL" must be authenticated by the name and address of the writer; not necessarily for publication, but as a proof of good faith.

COPY FOR ADVERTISEMENTS for the "JOURNAL" should be received at the Office NOT LATER than TWELVE O'CLOCK NOON ON MONDAY, to ensure insertion in the following day's issue.

Orders for Alterations in, or Stoppages of, PERMANENT ADVERTISEMENTS should be received by the FIRST POST on SATURDAY.

Wanted, For Sale, and Tender Advertisements, Six Lines and under 3s.; each additional Line, 6d.

TERMS OF SUBSCRIPTION to the "JOURNAL."

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All Communications, Remittances, &c., to be addressed to
WALTER KING, 11, BOLT COURT, FLEET STREET, LONDON, E.C.
Telegrams: "GASKING, LONDON." Telephone: P.O. 1571a Central.

OXIDE OF IRON.

O'NEILL'S OXIDE has a larger annual sale than all other Oxides combined.

SPENT OXIDE purchased in any district.

GAS PURIFICATION & CHEMICAL CO., LD.,

JOHN WM. O'NEILL, Managing Director,

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WINKELMANN'S

"VOLCANIC" FIRE CEMENT.

Resists 4500° Fahr. Best for GAS-WORKS.

ANDREW STEPHENSON, 182, Palmerston House, Old Broad Street, London, E.C. "Volcanism, London."

BROTHERTON & CO., LIMITED.

Offices: Commercial Buildings, LEEDS. Correspondence invited.

J. & J. BRADDOCK (Branch of Meters Limited), Globe Meter Works, OLDHAM, and 45 & 47, Westminster Bridge Road, LONDON, S.E.

First-Class Award, Melbourne Exhibition, 1889, for WET AND DRY GAS-METERS, STATION METERS, AND GOVERNORS, PRESSURE-GAUGES, STREET LAMPS AND PILLARS, &c.

Telegraphic Addresses:
"Braddock, Oldham." "Metrique, London."

DUTCH OXIDE OF IRON.

THE First Dutch Bog Ore Co., Ltd.
(Eerste Hollandsche Yzererts Maaty), ROTTERDAM.

General Manager for England and Wales)—
CHARLES E. FRY, LEAMINGTON; and at Tower Chambers, Brown Street, MANCHESTER.

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E. PADFIELD & CO., 96-98, Leadenhall Street, LONDON, E.C.

General Manager (for Scotland)—
J. B. MACDERMOTT, 11, Bothwell St., GLASGOW.

COAL GAS TAR wanted.

Gas Managers in Gloucester, Somerset, Worcester, Devon, Wilts, Hereford, Monmouth, and Glamorgan PLEASE NOTE. BEST PRICE offered, either on Fixed or Sliding-Scale Basis.

State Quantity to offer for Prompt and Forward Delivery.

The SHARPNESS CHEMICAL COMPANY, Tar Distillers, Sharpness Docks, GLOS.

OXIDE OF IRON.

(NATURAL.

BALE & CHURCH will be pleased to send Samples and Quotations, and make Offers for SPENT OXIDE.

BALE'S FIRE CEMENT, PAINT, AND GAS COAL.

5, CROOKED LANE, LONDON, E.C.

SULPHATE OF AMMONIA SATURATORS and LEAD WORK for Sulphate of Ammonia Plants.
For REPAIRS or ALTERATIONS, ring up "0848 BOLTON," or Telegraph "SATURATORS, BOLTON."
Largest Practice and most Up-to-Date Works in Britain.
JOSEPH TAYLOR AND CO., CENTRAL PLUMBING WORKS, BOLTON.

GAS TAR wanted.
BROTHERTON AND CO., LTD., Tar Distillers. Works: BIRMINGHAM, LEEDS, and WAKEFIELD.

IT is worth your while to buy direct. THE RELIANCE LUBRICATING OIL COMPANY 19 and 20, Water Lane, Great Tower Street, London, E.C., handle all kinds of Lubricating Oils, for Engines, Cylinders, Dynamos, Spindles, &c., Burning Oils, Solar Distillates, Carburetting Oils, and Spirits for Gas Making; Motor Oils, Fuel Oils, Animal, Fish, and Vegetable Oils, &c., for all purposes. Write for our "Trade Mark" Inkstand, sent free to customers. Non-customers, 2s. 6d. each. RELIANCE LUBRICATING OIL COMPANY, London, Glasgow, Newcastle-on-Tyne, &c. Established 1858. Telegraphic Address: "Subastral," London; A.B.C. Code used. Telephone No.: Avenue 5891.

NEW GAS PLANT CEMENT.
JOHN E. WILLIAMS AND CO.,
VICTORIA PAINT WORKS,
MANCHESTER.
For all Joints in connection with Oil-Gas Plant and Sulphate Plant.
For all Gas Joints.
For all Tar Joints.
For all Ammonia Joints.

SULPHURIC ACID for Sale.
BROTHERTON AND CO., LTD., Chemical Manufacturers. Works: BIRMINGHAM, LEEDS, and WAKEFIELD.

PENNY-IN-THE-SLOT WORK.
H. GREENE & SONS, Ltd., are prepared to give QUOTATIONS to Gas Companies or Corporations for FITTING UP COMPLETE and CARRYING OUT the WORK in its entirety, either in Iron or Compo.
SURREY ENGINEERING WORKS, BLACKFRIARS ROAD, LONDON, S.E.
Telephone: 1693 HOP. Telegrams: "LUMINOSITY."

PATENTS AND TRADE MARKS PUBLICATIONS. "MERCHANDISE MARKS ACT, and Decisions thereunder," 1s.; "TRADE SECRETS v. PATENTS," 6d.; "DOCTRINE of EQUIVALENTS, Mechanical and Chemical," 6d.; "SUBJECT-MATTER of PATENTS," 6d.
MEWBURN, ELLIS, & PRYOR, Chartered Patent Agents, 70 and 72, Chancery Lane, London, W.C. Telegrams: "Patent London." Telephone: No. 243 Holborn.

HYDRATED OXIDE OF IRON.
PREPARED from Pure Iron.
Twice as Rich as Bog Ore.
Gives no Back Pressure.
The Cheapest in the Market.
Can be Lent on Hire.
Can be Exchanged for Spent Oxide.
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AMMONIACAL LIQUOR wanted.
BROTHERTON AND CO., LTD., Ammonia Distillers. Works: BIRMINGHAM, LEEDS, and WAKEFIELD.

BY the adoption of Cripps's Bye-Pass VALVES inside your Purifiers, you can relieve the Back-Pressure in the Lower Tiers when the Purifying Material gets hard. They are extremely useful and economical.
Sole Makers: C. & W. WALKER, LIMITED, Midland Iron-Works, Donnington, near Newport, SHROPSHIRE.

GAS-METERS wanted, old disused Wet. Copper Lamp Frames, Brass, Pewter, Tin, Zinc, Lead Ashes, Old Copper Electric Cable, &c., for Cash.
J. SMITH, Canal Road, BRADFORD.

TO GAS AND WATER OFFICIALS.
GRAND Cycle Bargains, new and second hand "HUMBERS," "PREMIERS," "COURT ROYALS," "CENTAURS," "RUDGE-WHITWORTHS," "SWIFTS," "ROVERS," &c., on SPECIAL TERMS to Gas and Water Officials. Easy payments from 10s. monthly.
IMPERIAL CYCLE SUPPLY CO., COVENTRY.

AMMONIACAL Liquor wanted by JOHN RILEY & SONS, Hapton, near ACCRINGTON.

TRAVELLER is shortly Open to an ENGAGEMENT with a firm of Gas Engineers and Contractors. Extensive connection and can introduce good business.
Address No. 4032, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, a position in or near London as DRAUGHTSMAN or REPRESENTATIVE. Twelve Years' practical Experience with leading Gas Engineers. Well up in all branches of the Gas Industry.
Address No. 4046, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

STREET Lighting Engineer, Incandescent. Gas Lighting Specialist, practical, and thoroughly experienced, desires appointment. Highest References.
Address No. 4043, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

RETORT SETTER.
YOUNG Man seeks re-engagement. Age 21. Abstainer. Good Testimonials. Would not object to travel.
Address No. 4048, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

GENTLEMAN, with large Experience in Gas Engineering and good Connection in the South of England, is prepared to call on Gas-Works and take Particulars, Dimensions, &c., for Provincial Firms of Contractors tendering for work. Best credentials.
Address No. 4045, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, a Situation as Foreman in Gas-Works, or METER INSPECTOR, or any responsible position in Gas-Works. Used to Exhauster and Pumps, Engines, Sulphate Plant, &c. Seven Years' Experience at the Kidderminster Gas-Works.
Address W. BARKER, 74, Park Lane, KIDDERMINSTER.

AN energetic Man holding a position as Secretary and Manager would like to TAKE CHARGE of a 10 million to 20 million Works, or to act as Outdoor Superintendent. Life Abstainer. Age 34. Excellent Testimonials. Eight Years in present Situation.
Address No. 4034, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

A GENTLEMAN (Age 30), with Twelve Years' experience in a leading Gaslight Company—Correspondence (Shorthand), Rentals, Stock-Ledgers, Transfers, Shares, Board Records, Dividends, &c., &c.—desires an APPOINTMENT in or about London. Highest Testimonials. Personal References. Salary £100 per annum. One Month's Approbation.
Address No. 4033, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, a capable Man as Lamp- LIGHTER and CLEANER, with a knowledge of Incandescent Burners.
Only Men of good and reliable Character need apply to the MANAGER, Gas-Works, Wells, SOMERSET.

DRAUGHTSMAN Wanted, thoroughly familiar with Gasholders and General Gas-Works Plant, and capable of making Working Drawings and taking out Quantities for estimating or ordering Materials.
State Age, Experience, and Salary required, to C. & W. WALKER, Limited, Midland Iron-Works, Donnington, SHROPSHIRE.

WANTED, several thoroughly Compe- tent SERVICE LAYERS and FITTERS. Must be Experienced in Stove and Meter Fixing, &c.
Also GAS-FITTERS, experienced in fitting up Slot Installations and Incandescent Burners and the usual Outdoor Fitting Work of a Gas Company.
Apply, with References, stating Age, Experience, and Wages expected, to the ENGINEER Gas-Works, MITCHAM.

GENERAL Foreman required for large Provincial Gas-Works. Applicants not to exceed 40 Years of age. Must be steady and reliable, strict disciplinarian, accustomed to control of Men, good Carbonizer, familiar with Carburetted Water-Gas Plant, and preferably to have had Mechanical Training.
Wages £3 per week. No House, Coal, or Gas.
Applications, stating Age and Experience, accompanied by *copies* of not more than Three recent Testimonials, to be addressed to No. 4047, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C., not later than Wednesday, June 24, 1903.

WANTED, at once, a Working Fore- man, who must have full knowledge of the whole routine of Gas-Works and the working of Generator Furnaces, and be able to undertake Repairs of Mains, Services, &c. He must be a practical man, sober, steady, and capable of taking entire charge of the Works in the absence of the Manager.
Wages to commence at 38s. per week.
Apply, with not more than two recent Testimonials, stating present Position and Age, on or before June 13 next, to Mr. J. W. PORTASS, Manager, Gas-Works, BISHOP'S STORTFORD.

KIRKCALDY GASLIGHT COMPANY, LIMITED.
WANTED, a Manager for the above Company to take entire charge of their Works. Must have a knowledge of Regenerative Settings. Salary to commence with £325.
The new Manager is wished to enter on his duties not later than the 31st of August.
Applications, with twelve *copies* of Testimonials, to be lodged with the undersigned not later than the 20th of June. Any canvassing of Directors will disqualify for appointment.
WM. L. MACINDOE,
Secretary.
170, High Street, Kirkcaldy,
May 29, 1903.

COUNTY BOROUGH OF BOLTON.
(GAS DEPARTMENT.)
WANTED, a Foreman Gas-Main LAYER, not over 40 Years of age, competent to take the entire charge under the Gas Engineer, of all the Main-laying in the district. Wages to commence 45s. per week.
Applications, endorsed "Foreman Mainlayer," addressed to the Chairman of the Gas Department, and enclosing not more than three recent Testimonials, to be delivered at the Gas Offices, Hotel Street, Bolton, not later than Thursday, June 18.
R. G. HINNELL,
Town Clerk.
Town Hall, Bolton,
June 4, 1903.

ATHERSTONE GASLIGHT AND COKE COMPANY.
WANTED, on the 1st of September next, a WORKING MANAGER for the Atherstone Gas-Works (Yearly Make about 22,500,000 cubic feet).
Salary at the rate of £120 per annum, with House, Coal, and Gas free.
Applications, stating Age and Qualifications, with three original recent Testimonials, to be sent to me before Monday, the 22nd inst.
W. A. HALTON,
Secretary.
Atherstone, June 3, 1903.

WANTED, Gas Carbon, in Four Ton Lots or more, f.o.r. Must be Clean and Hard Lumps.
Address No. 4044, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WASHER-SCRUBBER wanted, capable of dealing effectually with about 250,000 cubic feet of gas per day.
Send Particulars to the HOLYWOOD GAS COMPANY, LTD., Co. Down.

TO BE SOLD—Purifiers, Two or Four, 10 feet square by 4 ft. 6 in. deep, planed Joints, Connections, and Overhead Girders.
Write J. WRIGHT, 181, QUEEN VICTORIA STREET, E.C.

FOR SALE—Four Purifiers, 6 feet square, by 2 ft. 10 in., complete with 6-inch Connections, Dry Centre-Valve, Bearing-Bars, Wood Grids, and Lifting Screws for Covers. All in excellent condition, and ready for removal.
Also one 8-inch STATION GOVERNOR.
Apply, MASTER, Walton Workhouse, LIVERPOOL.

GAS PLANT for Sale—I can always offer NEW and SECOND-HAND GAS APPARATUS, including Retorts and Fittings, Condensers, Exhausters, Scrubbers, Washers, Purifiers, Gasholders, Tanks, Valves, Connections, &c. Also a few COMPLETE WORKS. Compare Prices and Particulars before ordering elsewhere.
J. F. BLAKELEY, Gas Engineer, Thornhill, DEWSBURY.

FOR SALE.
A TWIN 16-Horse Power Crossley Otto GAS-ENGINE; Dowson GAS PLANT; Two sets of Deep-Well PUMPS; Horizontal Tandem Compound Condensing ENGINE, with double-acting Pump; Two double acting FORCE PUMPS; double Bucket WELL PUMPS; and Four Cart WEIGH BRIDGES.
For Particulars, apply to WATER-WORKS OFFICE, Redhill, SURREY.

SLOUGH GAS AND COKE COMPANY.
THE Directors have the following PLANT FOR SALE (in whole or in part), owing to the Company's removal to their New Works.
Two ANNULAR CONDENSERS, 2 ft. by 20 ft.
One SCRUBBER, 20 ft. high by 5 ft. diameter, with 8-inch Valves and Connections.
HYDRAULIC MAINS, Eight 16 in. by 16 in. with 8-inch Valves and Connections and 5-inch Ascension Pipes and Dips.
One Egg-Ended BOILER, 10 ft. 6 in. by 4 ft.
One " " 9 ft. by 3 ft. 6 in.
One 8000 cubic feet per hour STATION METER, with 8-inch Valves and Connections.
One 10,000 cubic feet per hour EXHAUSTER.
One 5000 " " "
One 5-Horse Power ENGINE.
One 3-Horse Power "
Three PURIFIERS, 12 ft. by 12 ft. by 5 ft.
The above can be seen by appointment with Mr. T. C. Webb, Engineer and Manager, Gas-Works, Slough, Bucks.
ARTHUR THOMAS,
Secretary.
High Street, Slough,
May 28, 1903.

GAS PLANT FOR SALE.
OWING to the acquirement of the Works of the Colne Vale Gas Company, and the closing down of these Works, the Longwood Gas Company have FOR SALE the following PLANT in good condition:—
One HOLMES' TOWER SCRUBBER, 5 ft. by 12 ft., mounted on Thurston's Square Tar-Extractor, 5 ft. 6 in. by 5 ft.
One HOLMES' WASHER, cylindrical, 16 ft. by 4 ft. 6 in., with Rope Driving Gear and Shaft.
One COWAN CYLINDRICAL STATION METER, measuring 6 ft. 6 in. by 6 ft., with 12-inch Connections; capacity 10,000 feet per hour.
One 5000 cubic feet per hour EXHAUSTER, with Accessories and Engine in duplicate.
One 500-light STATION METER.
One Wrought-Iron Cylindrical STORAGE TANK, 26 ft. by 7 ft.
One Cast-Iron STORAGE TANK, 6 ft. 6 in. by 5 ft. by 5 ft., with Cast-Iron Draw-Off Cock.
Six Cast-Iron CONDENSERS, each 9 ft. 6 in. high, and 2 ft. diameter, with square base, 17 ft. by 3 ft by 1 ft. 3 in., fitted with Cleaning-Out Lids for each Pipe.
The following MOUTH-PIECES, with Ascension and Dip Pipes to suit:—
28 OVALS, 18 in. by 14 in.
Seven OVALS, 18 in. by 15 in.
27 □ 21 in. by 15 in.
Two Cast-Iron SLAKING TROUGHS, 4 ft. by 2 ft. 6 in. by 2 ft.
Also 100 Second-hand STREET LANTERNS.
Inspection invited.
Further Particulars on application to
J. H. BREARLEY,
Gas Engineer.
Longwood.

BOROUGH OF HEYWOOD.

THE Gas Committee invite Tenders for the supply of 12,500 Tons of COAL and 500 tons of CANNEL.

Specification and Form of Tender may be obtained upon application to Mr. W. Whatmough, Gas Manager.

Sealed Tenders, marked "Coal," to be sent to me not later than Tuesday, June 16, 1903.

By order,
GEO. G. BOUCHIER,
Town Clerk.

Municipal Buildings, Heywood,
May 20, 1903.

HOLYHEAD AND NORTH WALES GAS AND WATER CORPORATION, LIMITED.

TENDERS FOR COAL.

THE Directors of the above Company are prepared to receive TENDERS for the supply and delivery of COALS to their various Works for the ensuing Year.

Full Particulars and Forms of Tenders may be had on application to the undersigned, to whom sealed Tenders, endorsed "Tender for Coal," must be sent not later than Twelve noon, on Thursday, June 25, 1903.

GEORGE E. SAVILLE,
Managing-Director.

Penmeanmawr,
June 5, 1903.

TO IRONFOUNDERS AND SMITHS.

THE Gas Committee of the Coventry Corporation invite TENDERS for the manufacture and delivery at their Foleshill Works of about 25 Tons of STEEL GIRDERS and SUNDRY CASTINGS required in the construction of a Pipe Subway, &c.

The Specification, with Form of Tender and Schedule of Quantities and Prints of Drawings, may be obtained on application to the undersigned on payment of One Guinea, which will be returned on receipt of *bonâ-fide* Tender.

The Committee do not bind themselves to accept the lowest or any Tender.

Sealed Tenders, addressed to the Chairman of the Gas Committee, Gas-Works, Coventry, and endorsed "Ironwork for Pipe Subway, &c.," must be delivered on or before Saturday, June 20 inst.

FLETCHER W. STEVENSON,
Engineer and General Manager.

Gas-Works, Coventry,
June 1, 1903.

TO BUILDERS AND CONTRACTORS.

THE Gas Committee of the Coventry Corporation invite TENDERS for the construction at their Foleshill Works, under the L. & N. W. Ry. Co.'s lines, of a PIPE SUBWAY, about 120 feet long, 12 ft. 6 in. wide, and 8 ft. 6 in. high, with Man-Way Shafts at each end. Also for the construction of Foundations of a VALVE-HOUSE, about 20 ft. by 18 ft., and formation of permanent way for about 890 Yards of SINGLE RAILWAY TRACK and the necessary Drains, &c., therefor.

Specification, with Form of Tender and Schedule of Quantities, may be obtained, and Drawings, seen on application to the undersigned on payment of One Guinea, which will be returned on receipt of *bonâ-fide* Tender.

The Committee do not bind themselves to accept the lowest or any Tender.

Sealed Tenders, addressed to the Chairman of the Gas Committee, Gas-Works, Coventry, and endorsed "Tender for Pipe Subway, &c.," to be delivered on or before Saturday, June 20 inst.

FLETCHER W. STEVENSON,
Engineer and General Manager.

Gas-Works, Coventry,
June 1, 1903.

GORING AND STREATLEY DISTRICT GAS AND WATER COMPANY, LIMITED.

TENDERS FOR GAS COALS.

FOR the supply of 500 Tons (more or less) delivered to Goring (G. W. Rly.) at such times and in such quantities as may be required.

Tenders, with Analysis and full Particulars of the Coal offered, to be sent, not later than June 26, fully addressed to the Secretary, Gas Offices, Goring-on-Thames, Oxon.

J. HUNT,
Secretary.

Gas Offices, Goring-on-Thames,
Oxon, June 3, 1903.

GORING AND STREATLEY DISTRICT GAS AND WATER COMPANY, LIMITED.

WATER-SUPPLY EXTENSIONS.

CONTRACT No. 1.

HIGH-PRESSURE RISING MAIN AND TELEPHONE CABLE.

THE Directors are prepared to receive TENDERS for the supplying, hauling, and laying of about 5000 Yards of HIGH-PRESSURE RISING MAIN from their existing Reservoir, Goring-on-Thames, to the new Reservoir Site, Greenmore Hill, Woodcote, Oxfordshire, in accordance with Plans and Specification prepared by their Engineer, Mr. George H. Robus, Mansion House Chambers, London, E.C., where Plans may be seen, and copy of Specification obtained, on payment of £3 3s., which will be returned on receipt of a *bonâ-fide* Tender.

The Directors reserve the right to accept the lowest or any Tender.

Sealed Tenders, endorsed "Water-Works Extensions," and addressed to the Chairman, Goring and Streatley District Gas and Water Company, Limited, 20, Bucklersbury, London, E.C., should reach me not later than June 26, 1903.

The Engineer will attend at the Water-Works, Goring-on-Thames, on Friday, June 19, 1903, at Two o'clock, for the purpose of going over the proposed Line of Main with intending Contractors or their Representatives.

J. HUNT,
Secretary.

London, June 2, 1903.

FENTON URBAN DISTRICT COUNCIL.

TENDERS FOR GAS COAL.

THE Gas Committee of the above Council invite TENDERS for the supply and delivery of 8000 Tons of GAS COAL, BURGY, NUTS, or BEANS for the Twelve Months commencing the 1st of July next.

Specification and Form of Tender may be obtained on application to the undersigned.

Sealed Tenders, endorsed "Coal," to be forwarded to the Chairman, Gas-Works, Fenton, Staffs., not later than Saturday, the 20th of June, 1903.

The lowest or any Tender not necessarily accepted.

ROBERT SURTEES,
Engineer and Manager.

Gas-Works, Fenton, Staffs.,
June 5, 1903.

GAINSBOROUGH URBAN DISTRICT COUNCIL.

(GAS DEPARTMENT.)

TENDERS FOR GAS COAL.

THE Gas Committee of the above Council invite TENDERS for the supply of 6000 Tons of best GAS COAL (screened, unscreened, or nuts), to be delivered at the G. C. Railway Station, Gainsborough, between the 1st of July, 1903, and the 30th of June, 1904, in such quantities, monthly, as may be required.

Sealed Tenders, endorsed "Tender for Gas Coal," giving full Particulars of the Coal offered, to be addressed to the Chairman of the Gas Committee, must be delivered at the Gas-Works, Gainsborough, not later than the 23rd inst.

No special Form of Tender issued.

The Committee do not bind themselves to accept the lowest or any Tender.

JOHN BALDWIN,
Manager.

Gas-Works, Gainsborough,
June 6, 1903.

TENDERS FOR TAR.

THE Gas Committee of the Carnarvon Corporation invite TENDERS for the purchase of the surplus TAR made at their Works during the Twelve Months ending the 31st of August, 1904.

The Tar will be loaded free into Contractor's Tank-Trucks on Rail at the Gas-Works Siding, Carnarvon.

Payments: Net Cash Monthly.

Sealed Tenders, endorsed "Tender for Tar," and addressed to the Chairman of the Gas Committee, Guildhall, Carnarvon, to be delivered on or before Thursday, the 25th inst.

The Committee do not bind themselves to accept the lowest or any Tender.

Any further Information may be had from the undersigned.

WILLIAM M. RUXTON,
Manager.

Gas Office, Carnarvon,
June 1, 1903

TENDERS FOR GAS COAL.

THE Gas Committee of the Carnarvon Corporation invite TENDERS for the supply of 3000 Tons of best screened GAS COAL and 200 Tons of screened CANNEL, to be delivered free as required, in Trucks on the Gas-Works Siding, Carnarvon, during the Twelve Months ending the 31st of August, 1904.

Sealed Tenders, endorsed "Tender for Coal," and addressed to the Chairman of the Gas Committee, Guildhall, Carnarvon, to be delivered on or before Thursday, the 25th inst.

The Committee reserve to themselves the right to divide the quantity into two or more Contracts, and do not bind themselves to accept the lowest or any Tender.

Forms of Tender and Specification to be had on application to the undersigned.

WILLIAM M. RUXTON,
Manager.

Gas Office, Carnarvon,
June 1, 1903.

BOROUGH OF CHORLEY.

TO COLLIERY OWNERS AND OTHERS.

THE Chorley Corporation invite TENDERS for the supply of GAS FUEL required at their Gas-Works, for a period of Twelve Months from the 1st of July, 1903.

Forms of Tender, and Particulars and Quantities, may be obtained on application to Mr. J. W. Allin, Gas Engineer, Chorley.

Tenders, endorsed "Gas Fuel," to be sent to me on or before Tuesday, June 16, 1903.

The Corporation do not bind themselves to accept any Tender.

By order,
JNO. MILLS,
Town Clerk.

Town Hall, Chorley,
June 5, 1903.

BOROUGH OF CHORLEY.

(GAS DEPARTMENT.)

THE Chorley Corporation invite TENDERS for the following:—

1.—PURCHASE of SURPLUS TAR, about 700 Tons.	For Twelve Months, commencing 1st of July, 1903.
2.—SUPPLY of LUMP LIME, SMALL LIME, or LIME ASHES, 600 Tons or thereabouts.	
3.—SUPPLY of BRIMSTONE ACID, 100 Tons or thereabouts.	
4.—SUPPLY of PYRITES ACID, 150 Tons or thereabouts.	

Form of Tender for Acid, or any other Information, may be obtained on application to Mr. Jno. W. Allin, Gas Engineer, Chorley.

Tenders, duly endorsed, to be delivered to me on or before Tuesday, the 16th of June, 1903.

The Corporation do not bind themselves to accept any Tender.

order,
JNO. MILLS,
Town Clerk.

Town Hall, Chorley.

GAS TAR.

THE Urban District Council of Ather- ton invite TENDERS for the purchase of the TAR produced at their Gas-Works during Twelve Months from the 30th of June inst.

Probable quantity about 450 Tons.

Sealed Tenders to be delivered to the undersigned on or before Wednesday, the 17th inst.

D. SCHOFIELD,
Clerk.

WALLASEY URBAN DISTRICT COUNCIL.

(GAS AND WATER DEPARTMENT.)

TO GAS-METER MAKERS AND MAKERS OF GAS PLANT.

THE Wallasey Urban District Council are prepared to receive TENDERS for the supply, delivery, and erection of a STATION GAS-METER, at their Gas-Works, Great Float, near Birkenhead.

Copies of the Specification, together with full Information, can be obtained on application to the Engineer, Mr. J. H. Crowther, at his Office at the Works as below.

Sealed Tenders, on the Form embodied in the Specification, addressed to the undersigned, and endorsed "Tender for Station Gas-Meter," to be delivered per post, at my Office, as below, not later than the morning of Thursday, June 18, 1903.

The Contractor will be required to enter into a Bond, with approved sureties, for the due performance of the Contract.

The Council do not bind themselves to accept the lowest or any Tender.

By order,
H. W. COOK,
Clerk and Solicitor to the Council.

Public Offices, Egremont,
Cheshire, June 1, 1903.

TAR AND AMMONIACAL LIQUOR.

THE Lymm Urban District Council are prepared to receive TENDERS for the purchase of the surplus TAR and AMMONIACAL LIQUOR made at their Gas-Works, for a term of One Year from the 1st day of July, 1903 (or for such longer term as may be contracted for with the consent of the Council).

Tar and Liquor will be delivered free into Contractor's Boat on the Bridgwater Canal.

Tenders, to be sent to the undersigned on or before the 18th day of June, 1903, endorsed "Tar."

The purchaser will be required to enter into an agreement with the Council for the due performance of his Contract.

The Council do not bind themselves to accept the highest or any Tender.

Forms of Tender are not supplied.

Further Particulars may be had on application to the Gas Manager, Mr. W. L. Donaldson.

W. MULLARD,
Clerk.

Council Offices, Lymm, Cheshire.
June 2, 1903.

URBAN DISTRICT COUNCIL OF LYMM.

THE above Council are prepared to re- ceive TENDERS for the supply of CANNEL and best screened GAS COAL, to be delivered at their Gas-Works in Lymm for a term of Twelve Months from the 1st day of July, 1903.

The probable quantities required will be about 150 Tons of Cannel and about 1700 Tons of Gas Coal, which must be freshly wrought, well screened, and free from Sulphurous Pyrites, and other Objectionable Matter; but the Council reserve the right of increasing or decreasing the quantities named.

The person whose Tender is accepted will be required to enter into an agreement with the Council for the due performance of his Contract.

Sealed Tenders, stating price per ton delivered alongside the Works, to be sent to the undersigned on or before the 18th day of June, 1903, and endorsed "Coal Tender."

The Council do not bind themselves to accept the lowest or any Tender.

Forms of Tender are not supplied.

Further Particulars may be had on application to the Gas Manager, Mr. W. L. Donaldson.

W. MULLARD,
Clerk.

Council Offices, Lymm,
Cheshire, June 2, 1903.

URBAN DISTRICT COUNCIL, BOROUGH OF NEWRY.

TENDERS FOR GAS COAL.

THE Gas Committee of the above Council invite TENDERS for the supply of from 3500 to 4000 Tons of best screened GAS COAL (with quotation for unscreened Gas Coal at same time) for a period of Twelve Months, to be delivered in such quantities and at such times as may be required by the Committee, and to weigh 20 cwt. to the Ton over the Gas Committee's Weighbridge at their Works (said Machine is regularly inspected by Officer under Weights and Measures Act), and delivered *free ex* Ship or Steamer at Albert Basin, Newry.

The Coal to be Fresh Wrought, Dry, and Free from Hards, Smudge, Dirt, Shale, Pyrites, or other Objectionable Matter for Gas Making.

Further Particulars may be obtained from Mr. B. Gibson, Manager.

Sealed Tenders, endorsed "Tender for Coal" specifying the description and quality of the Coal, and where raised, to be addressed to T. P. Ledlie, Esq., Chairman, and delivered to the undersigned not later than 10.30 a.m., on Friday, the 19th of June.

The Committee reserve to themselves the right to accept the whole or any portion of any quantity offered, and do not bind themselves to accept the lowest or any Tender. They also reserve the power to decline acceptance of any Coal not equal in their belief to that contracted for.

ROBERT H. DOHERTY,
Clerk,
Urban District Council of Newry,

New Town Hall, Newry,
May 29, 1903.

THE BRISTOL GAS COMPANY.

RETORT CARBON.

THE Directors invite Tenders for the purchase of about 45 Tons of CARBON lying at the respective Works of the Company.

Particulars may be obtained on application to

JOHN PHILLIPS,
Secretary.

Chief Offices: Canon's Marsh,
Bristol, May 28, 1903.

THE Directors of the Camborne Gas Company, Limited, are prepared to receive TENDERS for the supply of 1500 Tons of GAS COAL f.o.b. to order of the said Company from July 1, 1903, to July 1, 1904.

No Form of Tender is issued; but the coal supplied must be of the best quality of the Pit named.

Alternative quotations c.i.f. Hayle may be also sent.

Tenders should be addressed, on or before the 13th of June, to the Secretary.

Gurney's Lane, Camborne,
May 30, 1903.

COUNTY BOROUGH OF SALFORD.

(GAS DEPARTMENT.)

THE Gas Committee invite Tenders for the supply and erection of RETORT-HOUSE FLOOR, RETORT BRACING, &c., required at their Albion Street Works.

The Drawings may be seen, and copy of the Specification and Form of Tender obtained (for which a charge of £1 1s. will be made, to be returned on receipt of a *bonâ-fide* Tender), on application to Mr. William W. Woodward, Engineer, Gas Offices, Bloom Street, Salford.

Sealed Tenders, endorsed "Tender for Retort-House Floor," addressed to the Chairman of the Gas Committee, to be delivered to me not later than Three p.m., on Thursday, the 25th of June, 1903.

L. C. EVANS,
Town Clerk.

Town Hall, Salford,
June 2, 1903.

COUNTY BOROUGH OF BURY.

TENDERS FOR GAS COALS.

THE Gas Committee are prepared to receive TENDERS for the supply of:—

40,000 Tons of GAS COAL
500 Tons of BURGY
300 Tons of HOUSE COAL
} More or less

Forms of Tender and Conditions of Contract may be obtained on application to Mr. H. Simmonds, Engineer and Manager, Gas-Works, Bury.

Tenders, endorsed "Gas Coal," to be sent to the undersigned not later than Saturday, the 13th day of June, 1903.

JOHN HASLAM,
Town Clerk.

Municipal Offices,
Bank Street, Bury.
May 26, 1903.

CORPORATION OF LANCASTER.

(GAS DEPARTMENT.)

TENDERS FOR GAS COAL.

THE Gas Committee are prepared to receive TENDERS for the supply of screened GAS COAL, to be delivered on the Gas-Works Siding, Lancaster, in such quantities and at such times as may be required, during a period of Twelve Months, commencing delivery July 1 next.

Sealed Tenders, endorsed "Gas Coal," giving full Particulars of the Coal offered, must be delivered to T. C. Hughes, Esq., Town Clerk, Lancaster, on or before Friday, June 12.

Any further Information and Forms of Tender may be obtained on application to the undersigned.

C. ARMITAGE,
Manager.

Gas-Works, Lancaster.

MALTON GAS COMPANY.

TENDERS FOR GAS COAL.

THE Directors of the Malton Gas Com- pany are prepared to receive TENDERS for the supply of 4000 Tons of GAS COALS, COBBLES, or NUTS, to be delivered in such monthly quantities as may be required by the Company.

Tenders to state the Price of the Coal delivered at Malton Station (N.E. Railway) free of all charges.

The Directors do not bind themselves to accept the lowest or any Tender.

Further Particulars may be obtained on application to the undersigned.

Sealed Tenders, endorsed "Tender for Coal," specifying the description and quality of Coal, to be sent on or before the 13th of June next.

HENRY TOBEY,
Engineer and Secretary.

Malton, May 27, 1903.

THE SHREWSBURY GASLIGHT COMPANY.

TENDERS FOR COAL.

THE Directors of the Shrewsbury Gas- light Company invite TENDERS for the supply of about 16,000 Tons of Screened GAS COAL, to be delivered free at the Great Western or London and North-Western Goods Yard, Shrewsbnry, during the Year commencing July 1, 1903, and ending June 30, 1904.

The Directors reserve to themselves the right to divide the quantity into two or more Contracts, and do not bind themselves to accept the lowest or any Tender.

Tenders must be made on Forms (containing further Particulars) which may be obtained on application at the Company's Works, or by post, and must be sent to the undersigned, on or before the 13th day of June, 1903.

By order.
WM. BELTON, Assoc.M.Inst.C.E.
Secretary and Manager.

Gas-Works, Shrewsbury,
May 13, 1903.

BRITISH GASLIGHT COMPANY, LIMITED.

NORWICH WORKS.

TENDERS are invited for the Erection of RETORT-HOUSE, COAL-STORES, and other BUILDINGS.

Bill of Quantities, Specifications, and Drawings may be seen at my Office, Bishop Bridge, Norwich, on or after the 8th of June.

Tenders to be deposited at the London Office of the Company, 11, George Yard, Lombard Street, addressed H. Burton Chamberlain, Esq., Secretary, not later than the 22nd of June, 1903, and endorsed "Tender for Buildings."

The Company do not pledge themselves to accept the lowest or any Tender.

THOMAS GLOVER,
Engineer and Manager.

Norwich, May, 1903.

BRIDGNORTH CORPORATION GAS-WORKS.

TO COLLIERY PROPRIETORS AND OTHERS.

THE Gas Committee are prepared to receive sealed TENDERS for the supply of GAS COAL, including carriage to the Bridgnorth Railway Station, for One Year from or soon after the end of July next.

Evidence as to quality of Coal must accompany each Tender.

Quantity required: About 2200 Tons to 2500 Tons in proportionate deliveries as directed—say, 70 per cent. during Winter Months, and 30 per cent. during Summer Months.

Sealed and marked Tenders must be sent to the undersigned not later than Monday, the 15th of June.

The Committee reserve to themselves the right to divide the quantity into two or more Contracts, and do not bind themselves to accept the lowest or any Tender.

Official Forms for Tender are not furnished.

By order,
J. H. COOKSEY,
Town Clerk, Secretary.

Bridgnorth,
May 29, 1903.

CARDIFF GASLIGHT AND COKE COMPANY.

TENDERS FOR COALS.

THE Directors of the above Company are prepared to receive TENDERS for a supply of 80,000 Tons of Best Well-Screened Large GAS COALS, to be delivered between the 1st of July, 1903, and the 30th of June, 1904, in monthly quantities in accordance with the Specification.

Parties tendering may do so for the whole quantity, or for quantities from 5000 tons upwards.

Forms of Tender and Specification of monthly deliveries may be obtained on application to the Engineer and Manager, Mr. H. Morley, M.Inst. C.E.

Sealed Tenders to be sent to the undersigned not later than Ten a.m. on Thursday, the 25th day of June next, addressed to the Chairman of the Company, endorsed "Tender for Coal."

The Directors do not bind themselves to accept the lowest or any Tender, and reserve to themselves the right to apportion the whole quantity as they may think fit.

By order,
GEORGE CLARRY,
Secretary.

Gas Offices, Cardiff,
May 16, 1903.

BOROUGH OF LEIGH.

(GAS AND WATER DEPARTMENTS.)

THE Gas and Water Committee of the above Corporation are prepared to receive TENDERS for the supply of the following goods:—

1—14,000 Tons of Screened Arley GAS COAL.
2—400 Tons of CANNEL.
3—Wrought-Iron TUBES and FITTINGS.
4—LEAD PIPE.
5—GAS-METERS.
6—VITRIOL.
7—LIME.
8—BENZOL.

Forms of Tender and further Particulars may be obtained on application to Mr. James Gibson, Gas and Water Manager, Leigh.

Sealed and endorsed Tenders must be delivered to the undersigned on or before Twelve o'clock noon on Saturday, the 13th day of June next.

The Corporation do not bind themselves to accept the lowest or any Tender, and reserve to themselves the right to divide any Tender.

By order,
PEREGRINE THOMAS,
Town Clerk.

Town Hall, Leigh, Lancs.,
May 27, 1903.

MARKET HARBOROUGH URBAN DISTRICT COUNCIL.

(GAS DEPARTMENT.)

TENDERS FOR GAS COAL AND SULPHURIC ACID.

THE Gas Committee invite Tenders for GAS COAL.

The supply of the whole or part of 3700 Tons of best screened GAS COAL or NUTS, to be delivered as may be required during the Year ending June 30, 1904, at the Sidings of the London and North-Western or Midland Railway Station, Market Harborough.

SULPHURIC ACID.

The supply of SULPHURIC ACID, to be delivered in Senders' Carboys, at Market Harborough Station, as may be required during the Year ending June 30, 1904.

Conditions and Form of Tender may be obtained from the undersigned, to whom sealed Tenders, endorsed "Coal" and "Sulphuric Acid" respectively, must be delivered not later than Saturday, the 27th day of June, 1903.

The lowest or any Tender not necessarily accepted.

A. T. HARRIS,
Manager and Secretary.

Gas Office: St. Mary's Road,
Market Harborough, May 29, 1903.

BOROUGH OF SAFFRON WALDEN.

TENDERS FOR COAL.

THE Gas and Water Undertaking Committees of the Town Council are prepared to receive TENDERS for the supply of about 1350 Tons of best Screened GAS COAL, and about 230 Tons of best Hand-Picked Hard STEAM COAL respectively, for the Twelve Months ending the 30th of June, 1904.

Full Particulars can be obtained on application to Mr. A. H. Forbes, Borough Surveyor.

Sealed Tenders, endorsed "Tender for Gas Coal," or "Tender for Steam Coal," as the case may be, to be addressed and sent to me, the undersigned, not later than Five o'clock in the afternoon, on Monday the 29th day of June inst.

The lowest or any Tender will not necessarily be accepted.

W. ADAMS,
Town Clerk.

Saffron Walden, June 5, 1903.

CARDIFF GASLIGHT AND COKE COMPANY.

TENDERS FOR CAST-IRON PIPES.

THE Directors of the above Company are prepared to receive TENDERS for a supply of Cast-Iron Spigot and Socket PIPES, also IRREGULAR PIPES, for delivery from the 1st of July, 1903, to the 30th of June, 1904, in such quantities as may be required.

Forms of Tender and Specifications may be obtained on application to the Engineer and Manager, Mr. Hy. Morley, C.E.

Sealed Tenders to be sent to the undersigned not later than Ten a.m. on Thursday, June 25 next, addressed to the Chairman of the Company, and endorsed "Tender for Pipes."

The Directors do not bind themselves to accept the lowest or any Tender.

By order,
GEORGE CLARRY,
Secretary.

Gas Offices, Cardiff, June 3, 1903.

LINCOLN CORPORATION.

(GAS DEPARTMENT.)

TENDERS FOR COAL.

THE Gas Committee of the Lincoln Cor- poration invite TENDERS for the supply of 26,000 Tons of unscreened or screened GAS COALS and NUTS, to be delivered during a period commencing the 1st of July, 1903, and terminating the 30th of June, 1904.

Further Particulars and Forms of Tender may be obtained from the undersigned.

Sealed and endorsed Tenders, addressed to the Chairman of the Gas Committee, must be delivered on or before the 20th of June next.

The Committee do not bind themselves to accept the lowest or any Tender.

JNO. CARTER,
Manager.

Gas Offices, Lincoln,
June 4, 1903.

BOROUGH OF CONGLETON.

THE Gas Committee invite Tenders for the following:—

1.—GAS COAL.

The supply of Best Screened GAS COAL or NUTS for Gas-Making purposes, to be delivered in Senders' or Railway Company's Trucks at Brunswick Wharf, Congleton (N. S. R.), during the Twelve Months ending June 30, 1904.

Forms of Tender and Conditions may be obtained from the undersigned.

2.—LIME.

The supply of about 150 Tons of Best Hand-Picked LIME for Purifying Purposes, to be delivered in Senders' or Railway Company's Trucks at Brunswick Wharf, Congleton (N. S. R.), in such quantities and at such times as may be required during the Twelve Months ending June 30, 1904.

No Special Form required.

Tenders, endorsed "Coal" or "Lime" respectively, to be delivered at the Office of E. A. Plant, Esq., Town Clerk, Congleton, on or before Saturday, the 20th day of June, 1903.

The Committee do not bind themselves to accept the lowest or any Tender.

J. SMITH,
Engineer and Manager.

Gas-Works, Congleton,
June 3, 1903.

URBAN DISTRICT COUNCIL OF COLWYN BAY AND COLWYN.

(GAS DEPARTMENT.)

THE above Council invite Tenders for the supply of from 4000 to 4200 Tons of best screened GAS COAL, to be supplied during the ensuing Twelve Months ending June 30, 1904.

Tenders, stating price per ton, delivered as required free at Colwyn Bay Station, endorsed "Tender for Coal," to be sent in addressed to the undersigned on or before Wednesday, the 24th inst.

The Council do not bind themselves to accept the lowest or any Tender, and reserve the right to purchase any portion of the quantity offered.

TENDERS are also invited for the following

EXTENSIONS AT THE GAS-WORKS.

Namely, Three beds of Eight RETORTS on the Regenerator System, with Waddell's or Brearley's Regenerator Flues, and all Furnace Fittings, Retort Mountings, and Subway Floor.

Plans may be seen, and a copy of Specification and Form of Tender obtained, on application to Mr. Jno. C. Pennington, Gas Engineer and Manager, Colwyn Bay.

Sealed Tenders, endorsed "Gas-Works Extensions," to be sent in addressed to the undersigned on or before Wednesday, the 24th inst.

The Council do not bind themselves to accept the lowest or any Tender.

(Signed) JOS. H. ROBERTS.
Clerk.

Council Offices, Colwyn Bay,
June 6, 1903.

CORPORATION OF DUKINFIELD.
(GAS DEPARTMENT.)

TENDERS FOR GAS COAL.

THE Gas Committee require Tenders by the 24th of June, 1903, for 5000 Tons of best screened GAS COAL.

Specification and Forms of Tender on application to Mr. Harrison Veevers, Town Hall, Dukinfield.

Tenders to Mr. Councillor COOKE, Chairman of the Gas Committee, Town Hall, DUKINFIELD.

HARLOW AND SAWBRIDGEWORTH GASLIGHT AND COKE COMPANY, LIMITED.

TENDERS are invited for the supply of 1400 Tons of best GAS COAL, delivered free at Harlow Station, in such quantities, monthly, as may be required between July 1, 1903, and June 30, 1904.

No special Form of Tender provided.

Tenders, to be endorsed "Tender for Coal," giving full Particulars of the Coal offered, to be sent to me on or before June 24.

W. E. DEARDS,
Secretary.

Harlow.

TENDERS FOR COAL.

THE Directors of the Mold Gas and Water Company are prepared to receive TENDERS for the supply of about 1500 Tons of GAS COAL or NUTS, to be delivered at the Company's Siding during the Twelve Months ending June 30, 1904, in such quantities and at such times as the Manager shall from time to time direct.

Tenders, endorsed "Coal," to be delivered to the undersigned not later than June 30.

JAMES MACGREGOR,
Secretary and Manager.

Gas and Water Offices, Mold.

NEWARK GAS COMPANY.

THE Directors of the above Company invite TENDERS for the AMMONIACAL LIQUOR produced at their Works, free on Rail G.N.R. or M.R. in Purchaser's Tanks, for One Year from the 1st of July, 1903.

Terms: Cash Monthly.

Tenders must state price per ton per degree Twaddel's Hydrometer 5° and 8°, and be sent to the undersigned on or before Thursday, the 18th day of June, 1903, marked "Tender for Liquor."

The Directors do not bind themselves to accept the highest or any Tender.

By order,
FREDK. B. FOOTTIT,
Secretary.

Newark, June 3, 1903.

BOROUGH OF TORQUAY.

THE Gas-Works Committee of the Torquay Town Council are prepared to receive TENDERS for the supply of 2000 Tons of approved GAS COAL, delivered free into Stores at the St. Mary Church Gas-Works.

Further Particulars and Forms on which Tenders must be submitted may be obtained at my Office, Town Hall, Torquay.

Sealed Tenders, endorsed "Tender for Coal," to be sent to the undersigned not later than Four p.m. on Thursday, June 18, 1903.

The lowest or any Tender will not necessarily be accepted.

(Signed),
FREDK. S. HEX,
Town Clerk.

Town Hall, Torquay,
June 4, 1903.

CORPORATION OF MANCHESTER.

TENDERS FOR COAL AND CANNEL.

THE Gas Committee are prepared to receive OFFERS of high-class CANNELS, COALS, and WASHED NUTS suitable for Gas Making, for delivery at their Gaythorn, Rochdale Road, Bradford Road, and Droylsden Works, during a period of One or Two Years commencing the 1st of October, 1903.

Printed Forms of Tender may be obtained on application (in writing only) to Mr. Charles Nickson, Superintendent, Gas Department, Town Hall, Manchester; and Tenders, endorsed "Tender for Cannel or Coal," as the case may be, must be delivered at the Gas Department, Town Hall, Manchester, before Ten o'clock on Wednesday morning, the 24th of June, addressed to the Chairman of the Gas Committee.

By order of the Gas Committee.
WILLIAM HENRY TALBOT,
Town Clerk.

Town Hall, Manchester,
June 5, 1903.

ALTRINCHAM GAS COMPANY.

COAL AND CANNEL CONTRACTS.

TENDERS are invited for best screened GAS COAL, and CANNEL for One Year from the 1st of July, 1903.

Estimated quantities required: Coal, 11,000 Tons; Cannel, 4000 Tons.

Deliveries to be free at Altrincham Railway Station, and as required.

Sealed Tenders, endorsed "Tender for Coal" or "Cannel," stating the description of each, the pits from which they are to be raised, the amount proposed to be supplied, and cash terms for monthly payments, to be sent, addressed to the undersigned so as to be received not later than Twelve o'clock noon, on Wednesday, the 17th day of June, 1903.

The Directors do not bind themselves to accept the lowest or any Tender; but the person or persons whose tender may be accepted will be required to execute an Agreement for the due performance thereof.

No special Form of Tender is required or supplied.

F. R. B. LINDSELL,
Secretary.

Gas Office, Moss Lane,
Altrincham, May 30, 1903.

TAR Contracts Wanted on the Sliding Scale or at Fixed Prices.

Managers and Secretaries desirous of selling to best advantage please communicate with DENT AND CO., Ouse Chemical Works, SELBY.

BOROUGH OF NELSON.
(GAS DEPARTMENT).

TENDERS FOR GAS COAL.

THE Gas Committee invite Tenders for the supply of 34,000 Tons, or thereabouts, of GAS COAL, to be delivered during the period of Seventeen Months, commencing the 1st of November, 1903, and ending the 31st of March, 1905.

Full Particulars, together with Form of Tender, may be obtained on application to Mr. A. J. Hope, Engineer, Gas-Works, Nelson.

Tenders, sealed and endorsed "Coal," must be delivered to the undersigned not later than Ten a.m., on Friday, the 19th day of June, 1903.

J. H. BALDWICK,
Town Clerk.

Town Hall, Nelson,
June 1, 1903.

WORKSOP GAS COMPANY.

THE Directors of the Worksop Gas Company are prepared to receive TENDERS for the supply of 4500 Tons of the best screened GAS COAL, delivered at Worksop Station during the Year ending July 31, 1904. To be free as possible from Sulphur, Bats, Bind, Refuse, and Dirt, and shall be weighed (20 cwt. to the ton) upon the Company's Machine.

Tenders to be sent in to the undersigned on or before the 22nd of June, 1903.

No special Form of Tender provided.

The Directors reserve to themselves the right to accept Tenders for the whole or any portion of the quantity offered, and do not bind themselves to accept the lowest or any Tender.

F. KENT,
Manager.

June 4, 1903.

BRIDGEND GAS AND WATER COMPANY.

TENDERS FOR CAST-IRON PIPES.

THE Directors of the above Company invite TENDERS for the supply and delivery of Cast-Iron Socket and Spigot PIPES, coated—about 900 yards of 9-inch internal diameter, about 600 yards of 8-inch internal diameter. Approximate weight of each size Pipe to be given, and Price at per Ton; Specials at per Ton.

Delivery of Pipes to be completed within One Month from the date of acceptance of Tender.

The Directors do not bind themselves to accept the lowest or any Tender.

Tenders to be sent in on or before the 15th day of June, 1903, addressed to the Chairman of the Bridgend Gas and Water Company, Bridgend, Glamorgan, endorsed "Tender for Pipes."

J. H. DYER,
Secretary and Manager.

MOUNTAIN ASH URBAN DISTRICT COUNCIL.
(GAS DEPARTMENT.)

TO IRONFOUNDERS.

THE Council are prepared to receive TENDERS for the supply and delivery of about 2600 Yards of 10-inch and 1520 Yards of 4-inch CAST-IRON SOCKET PIPES.

Tenders, endorsed "Cast-Iron Pipes" and addressed to the undersigned, to be sent in on or before One p.m. on Tuesday, the 23rd of June, 1903.

Forms of Tender, Quantities, and all further Information may be obtained on application to Mr. John Williams, Town Hall, Mountain Ash.

The Council do not bind themselves to accept the lowest or any Tender.

H. P. LINTON.

Town Hall, Mountain Ash,
May 29, 1903.

BOROUGH OF EVESHAM.
(GAS DEPARTMENT.)

TENDERS FOR GAS COAL.

THE Corporation invite Tenders for the supply of from 1000 to 2000 Tons (or less if required) of best screened GAS COAL, during the Year ending the 30th day of June, 1904, to be delivered on rail at Evesham.

Tenders, to be sent to me not later than the 25th day of June inst., to include full description and particulars as to Coal and Price.

No Form of Tender supplied.

The Corporation do not bind themselves to accept the lowest or any Tender.

THOS. A. COX,
Town Clerk.

Town Clerk's Offices, Evesham,
June 4, 1903.

FENTON URBAN DISTRICT COUNCIL.

TAR AND AMMONIACAL LIQUOR.

THE Gas Committee of the above Council invite TENDERS for the purchase of the surplus TAR and AMMONIACAL LIQUOR made at their Works during the Twelve Months commencing the 1st day of July next.

Sealed Tenders to be sent in not later than Saturday, June 20, 1903, addressed Chairman, Gas-Works, Fenton, Staffordshire, and endorsed "Tender for Tar, &c."

The Committee reserve to themselves the right of accepting any Tender for the Tar or Liquor separately.

The Committee do not bind themselves to accept the highest or any Tender.

Further Particulars may be obtained on application to the undersigned.

ROBERT SURTEES,
Engineer and Manager.

Gas-Works, Fenton, Staffs.,
June 5, 1903.

READING GAS COMPANY.

TAR.

THE Directors of the Reading Gas Company invite TENDERS for the purchase of their Surplus TAR for One Year, commencing on the 1st of July next.

Specifications for the Contract will be forwarded on application.

Railway communication direct to the works.

Tenders, endorsed "Tender for Tar," must be delivered not later than Monday, the 22nd of June, to

ARTHUR H. CANE,
Secretary.

7, King Street, Reading,
June 3, 1903.

THE LEAMINGTON PRIORS GAS COMPANY.

TENDERS FOR GAS COAL.

THE Directors of the Leamington Priors Gas Company are prepared to receive TENDERS for the supply of the GAS COAL required by them during Twelve Months from the 1st of July next.

Particulars and Forms of Quotation may be obtained from the undersigned.

Tenders must be sent in on or before Tuesday, the 23rd of June, 1903.

THOMAS BERRIDGE,
Engineer and Secretary.

TENDERS FOR GAS COAL.

THE Corporation Gas Committee of Stoke-upon-Trent invite TENDERS for the supply of 12,000 Tons of GAS COAL.

Specification and Form of Tender may be obtained on application to the undersigned, or at the Gas Offices.

Tenders to be sent in not later than Twelve o'clock noon on the 16th day of June, 1903, addressed to F. Geen, Esq., J.P., Chairman of the Gas Committee, Stoke-upon-Trent, and endorsed "Tender for Gas Coal."

WM. PRINCE,
Engineer and Manager.

Gas Offices, Stoke-upon-Trent,
May, 1903.

TOTTENHAM AND EDMONTON GASLIGHT AND COKE COMPANY.

NOTICE is Hereby Given, that the TRANSFER BOOKS of the Company, so far as they relate to DEBENTURE STOCK, WILL BE CLOSED at Ten o'clock forenoon on Friday, the 12th of June, for the Half Year ending the 30th of June, 1903, and will be RE-OPENED on Friday, the 19th of June.

The Interest for the Half Year will be payable on the 1st day of July next to the Proprietors registered on the closing of the Books.

By order of the Board,
JAMES RANDALL,
Secretary.

Chief Offices: 639, High Road,
Tottenham, June 5, 1903.

SOUTH METROPOLITAN GAS COMPANY.

SALE BY TENDER OF £70,000 THREE PER CENT. PERPETUAL DEBENTURE STOCK.
MINIMUM PRICE £90 PER CENT.

NOTICE is Hereby Given, that it is the intention of the Directors of this Company to Sell by Tender £70,000 Three Per Cent. PERPETUAL DEBENTURE STOCK in accordance with the provisions of the South Metropolitan Gas Acts of 1882, 1896, and 1901.

Particulars of same, with Form of Tender, can be obtained at this Office, on application to the undersigned, and Tenders must be sent in on or before Tuesday, the 23rd day of June inst.

The Stock will be allotted to the highest bidders; but no tender will be accepted at a lower price than at the rate of £90 money for each £100 Debenture Stock.

By order,
FRANK BUSH,
Secretary.

Offices: 709, Old Kent Road, London, S.E.,
June 4, 1903.

Fourth Sale, Water Order, 1902.

BOROUGH OF PORTSMOUTH WATER-WORKS COMPANY.

IMPORTANT SALE OF NEW ISSUE OF SHARES
IN THIS OLD-ESTABLISHED AND GOOD DIVIDEND-PAYING COMPANY.

MESSRS. PENNEY AND CLARK beg to announce that they are favoured with instructions from the Directors of the above-named Company to SELL by PUBLIC AUCTION, at their Auction Mart, King's Road, Southsea, on Tuesday, June 16, 1903, at Seven o'clock in the Evening (in convenient Lots), the fourth portion of the New Issue authorized under the Borough of Portsmouth Water Order, 1902, consisting of—

2000 SHARES OF £5 EACH

(Fully Paid), forming part of the New Ordinary Capital authorized under such Order.

The Auctioneers would draw the attention of Capitalists, Investors, and Others to the fact that the experience of many Years has clearly demonstrated that Investments in Water Undertakings form by far the most profitable and unvarying source of income, and the above Sale presents an exceptional opportunity for the investment of either large or small amounts of Capital.

The Shares will be sold *Free of any Charges*, Fees, or Expenses whatever to the Purchaser.

Full Particulars and Conditions of Sale may be obtained, with any further Information, from the Secretary of the Company, J. L. WILKINSON, Esq., F.C.I.S., at the Company's Offices, Commercial Road, PORTSMOUTH; or of the AUCTIONEERS, at their Offices, THE AUCTION MART, King's Road, SOUTHSEA.

National Telephone No. 138.
Municipal Ditto No. 138.

GREAT WESTERN RAILWAY.

THE Directors of this Company are prepared to receive TENDERS for the purchase of:—
GAS TAR AND AMMONIACAL LIQUOR.
HYDROCARBON from Oil-Gas Works.
FURNACE SLAG, FETTLING and MILL SCALE.
TARPAULIN CUTTINGS and SHEET TIES.
DIRTY GREASE.

Forms of Tender (upon which alone Tenders will be received), may be obtained on application to the undersigned, by whom Tenders, marked outside "Tender for Residuals," will be received on or before Tuesday, the 23rd of June.

The Directors do not bind themselves to accept the highest or any Tender.

G. K. MILLS,
Secretary.

Paddington Station, London,
June 3, 1903.

EAST LONDON WATER-WORKS COMPANY.

NOTICE is Hereby Given, that the TRANSFER BOOKS in respect both to the Four-and-a-half per Cent. and the Three per Cent. Debenture Stocks, WILL BE CLOSED from the 11th to the 30th of June inst., both days inclusive, and re-opened on the 1st of July prox., on which day the Interest Warrants on these Stocks will be payable.

By order,
I. A. CROOKENDEN,
Secretary.

St. Helen's Place,
Bishopsgate Street, E.C.
June 2, 1903.

ISSUES BY AUCTION OF GAS AND WATER STOCKS AND SHARES.

MR. ALFRED RICHARDS begs to notify that his ISSUES by AUCTION under PARLIAMENTARY POWERS of STOCKS and SHARES in LONDON, SUBURBAN, and PROVINCIAL GAS and WATER COMPANIES take place PERIODICALLY at the Mart, TOKENHOUSE YARD, E.C.

Terms for Issuing such Capital, and also for including Gas and Water Stocks and Shares belonging to Private Owners in these Periodical Sales, can be obtained on application at Mr. ALFRED RICHARDS' OFFICES, 18, FINSBURY CIRCUS, E.C.

By order of the Directors of the
WEST HAM GAS COMPANY.

NEW ISSUE OF £15,000 CONSOLIDATED ORDINARY STOCK.

MR. ALFRED RICHARDS will Sell the ABOVE BY AUCTION, at the Mart, E.C., on Tuesday, June 16, at Two o'clock, in Lots.
Particulars of the AUCTIONEER, 18, FINSBURY CIRCUS, E.C.

By order of the Directors of the
TONBRIDGE GAS COMPANY.

NEW ISSUE OF £5000 FOUR PER CENT. PERPETUAL DEBENTURE STOCK.

MR. ALFRED RICHARDS will Sell the ABOVE BY AUCTION, at the Mart, E.C., on Tuesday, June 16, at Two o'clock, in Lots.
Particulars of the AUCTIONEER, 18, FINSBURY CIRCUS, E.C.

By order of the Directors of the
SOUTH ESSEX WATER-WORKS COMPANY.

NEW ISSUE OF £5000 ORDINARY STOCK.

MR. ALFRED RICHARDS will Sell the ABOVE BY AUCTION, at the Mart, E.C., on Tuesday, June 16, at Two o'clock, in Lots.
Particulars of the AUCTIONEER, 18, FINSBURY CIRCUS, E.C.

GAS STOCKS AND SHARES.

MR. ALFRED RICHARDS will Sell by AUCTION, at the MART, E.C., on TUESDAY, JUNE 16, at Two o'clock in Lots, Stocks and Shares in the following:—

CROYDON COMMERCIAL GAS AND COKE COMPANY;
PORTSEA ISLAND GASLIGHT COMPANY;
and the
MALTA AND MEDITERRANEAN GAS COMPANY, LIMITED.

Particulars of the AUCTIONEER, 18, FINSBURY CIRCUS, E.C.

By order of Trustee, and another.

COLNEY HATCH GAS COMPANY,
100 £10 ORIGINAL SHARES, Dividend 10 per Cent.

HORLEY DISTRICT GAS COMPANY,
£225 ORIGINAL STOCK, ranking for a Maximum Dividend of 10 per Cent. Dividend for 1902, 4¾ per Cent.

GORING AND STREATLEY DISTRICT GAS AND WATER COMPANY, LIMITED,
60 £5 ORIGINAL GAS CAPITAL and 30 £5 ORIGINAL WATER CAPITAL SHARES; Dividends for 1901 and 1902, on each Class of Shares, 5 per Cent. per annum.

ALDEBURGH GASLIGHT COMPANY, LIMITED,
10 £10 SHARES; Dividend 10 per Cent., Free of Income-Tax.

MESSRS. EDWIN FOX & BOUSFIELD will include the above in their next STOCK and SHARE AUCTION, at the Mart, E.C., on Wednesday, June 17, at 2.30 o'clock, in Lots.
Particulars at the AUCTIONEERS' OFFICE, 99, Gresham Street, BANK, E.C.

Net Price: Cloth Bound, 12s. 6d.; Morocco Gilt 18s.

Gas Companies' Book-Keeping.

BY
JOHN HENRY BREARLEY & BENJAMIN TAYLOR
OF LONGWOOD.

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WALTER KING, 11, Bolt Court, FLEET STREET, E.C.

Part 2 Now Ready. *Price* **6d.**

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For Hand or Power. On Tooth-cutter or Jaw Principles.
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Prices and Analysis of all the Scotch Cannels on Application.

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HEATHCOTE GAS COAL.

Rich in Illuminating Power and Yield of Gas.
Above the Average in Weight and Quality of Coke.
Maintains a High Standard in Residuals.

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CHESTERFIELD.

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Operated Entirely by One Handle

Class A lifts 25 ft.
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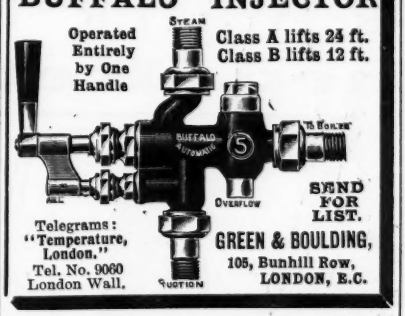

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LONDON, E.C.

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SHEAF WORKS, SHEFFIELD,
MANUFACTURERS OF
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STEEL OF ALL DESCRIPTIONS.
SCREW STOCKS, TAPS AND DIES,
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Are prepared to erect Installations from 50 to 2000 Lights of their

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NEWBATTLE CANNEL.

Highest Results in Gas, & Excellent Coke.

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UNEQUALLED.

Gas Companies are solicited to try Samples of the

MIRFIELD
BLACK BED GAS COAL.

Prices and Analysis on application.
MIRFIELD (GAS-COAL) COLLIERY COMPY.
RAVENSTHORPE, NEAR DEWSBURY.

THE "MENIER"
AUTOMATIC LIGHTER.

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12,000 in France and Belgium.

Price 5s.

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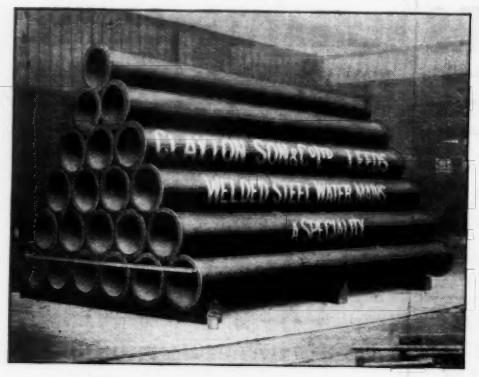

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A SPECIALITY

FOR ALL PURPOSES, TO STAND ANY PRESSURE AND PASS ANY INSPECTION.

CONTRACTS UNDERTAKEN FOR ANY LENGTH OF

PIPE LINE For Water, Steam, Oil, Hydraulic, or Pneumatic Pressure; also for Gas or Air. Any diameter from eight inches upwards.

COMPLETE GAS PLANTS.

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ALSO MAKERS OF STEEL STORAGE TANKS.

Structural Iron & Steel Work,

HIGH-CLASS BOILERS,

For High Pressures, fitted with DEIGHTON'S PATENT CORRUGATED FLUES, giving increased heating surface and highest economy in working.

ON ADMIRALTY AND WAR OFFICE LISTS.

MOBBERLEY & PERRY,

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Large Stocks kept.

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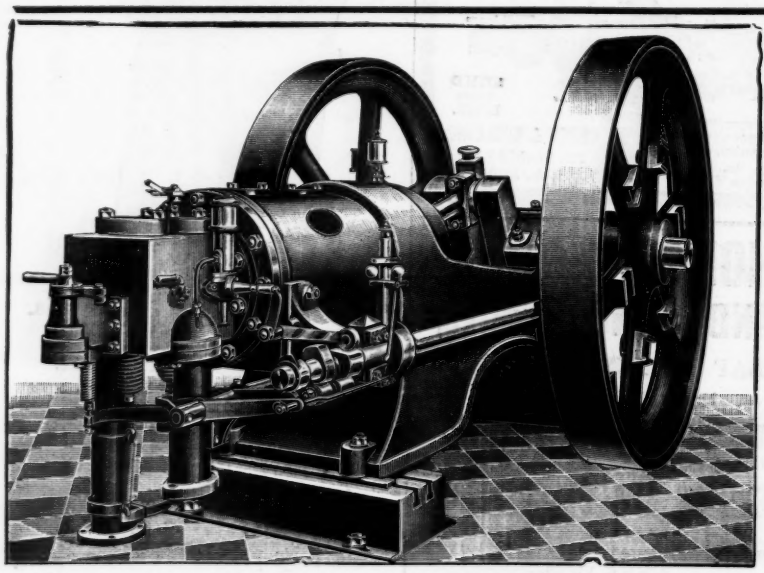

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Sole Manufacturers of

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1 .. .. 26 ,,
1 .. .. 22 ,,
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2 .. each 16 ,,

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Have 2 ENGINES, each 125 B.H.P
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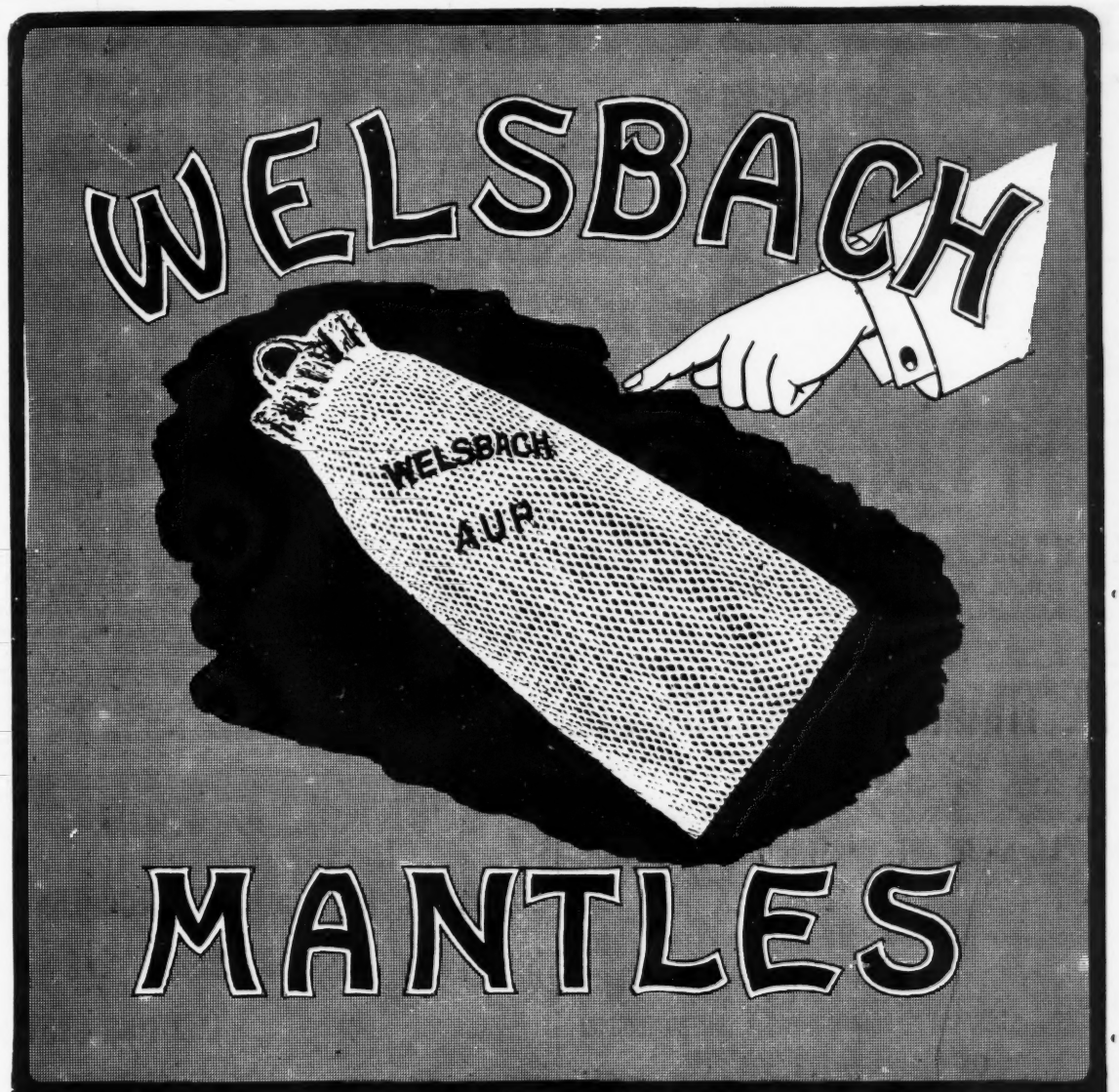

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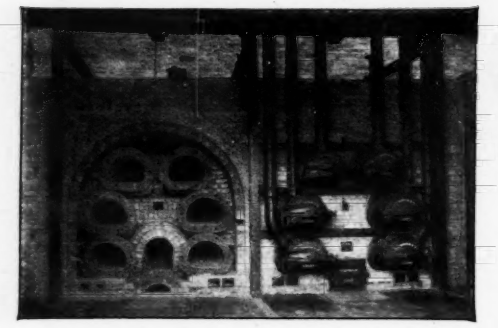

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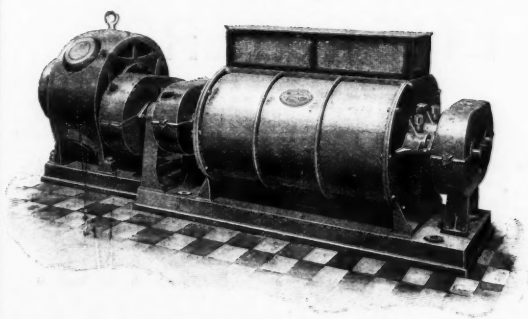

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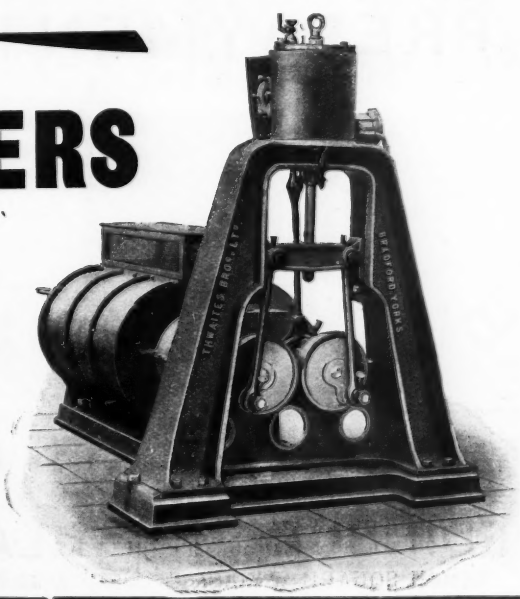

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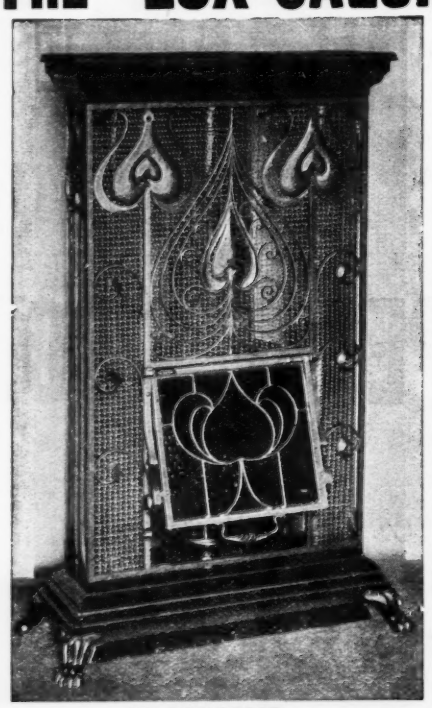

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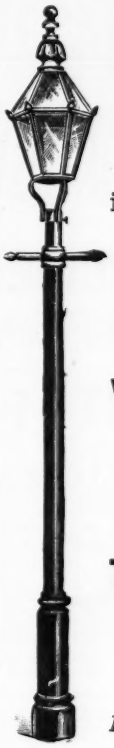

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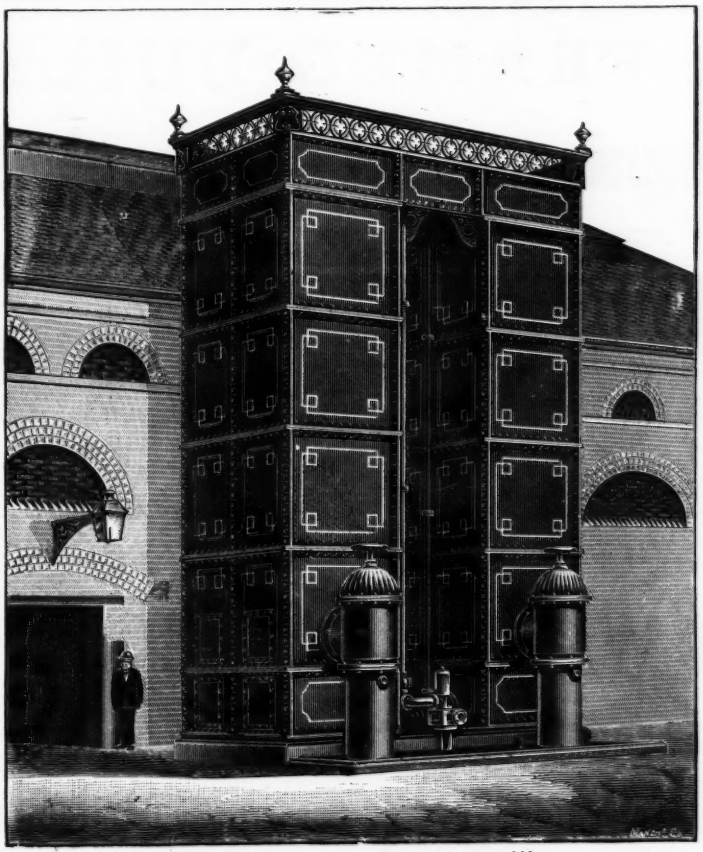

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